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AMERICAN DENTAL ASSOCIATION

AT THE

TWENTY-EIGHTH ANNUAL SESSION,

HELD AT LOUISVILLE, KY.,

BOSTON MEDICAL LIBRARY ASS'N.
JUN 29 1891

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COMMENCING ON THE 28TH OF AUGUST, 1888.

PUBLICATION COMMITTEE:

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* These go out August, 1889.

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MINUTES OF TRANSACTIONS

OF THE

AMERICAN DENTAL ASSOCIATION.

SESSION OF 1888.

BY GEORGE H. CUSHING, SECRETARY.

FIRST DAY—MORNING SESSION.

THE AMERICAN DENTAL ASSOCIATION commenced its Twenty-eighth Annual Session in the Female High School building, Louisville, Kentucky, on Tuesday, August 28, 1888, at 9.30 A.M., the President, Frank Abbott, in the chair.

The roll being called, the following were found either to be present or to have forwarded their dues:

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Any inaccuracies in the above list, in name or location, should be reported to the Treasurer at once, in order that the necessary corrections may be made.

Annual dues being payable in advance, no name appears on above list except of those who have paid for 1888, and Transactions are not sent to any who have not fully paid their dues.

Dues must be paid to the Treasurer. Send draft, P. O. money order, or express order. *Never* send currency by mail.

A. H. FULLER, *Treasurer*,
2602 Locust st., St. Louis, Mo.

On motion, the reading of the printed minutes was dispensed with.

The minutes *ad interim* were then read and approved, as follows:

MINUTES OF BUSINESS TRANSACTED *AD INTERIM*.

On September 23 the Secretary received the following letter:

DR. GEO. H. CUSHING, *Recording Secretary of the American Dental Association:*

DEAR SIR,—At a conference held at Old Point Comfort between the committee appointed by the American Dental Association and the officers of the Southern Dental Association, it was concluded that the best time and place for the next meeting of the Association would be on the 28th of August, at Louisville, Kentucky.

In order to make such change legal it will be necessary to secure a vote of ten of the officers of the Association in its favor. Will you take a vote on the above proposition and act in accordance with the result of such vote?

Yours very truly,

FRANK ABBOTT, M.D., *President A. D. A.*

NEW YORK, Sept. 21, 1887.

In accordance with the above instructions a vote was taken, and, thirteen of the fifteen officers voting for the change, notice was duly given, and arrangements made with the officers of the Southern Dental Association for a Joint Meeting, programmes for which have been mailed to all members.

The President appointed as the Local Committee of Arrangements W. W. Walker, New York, Chairman; M. W. Foster, Baltimore; Thos. T. Moore, Columbia, S. C.; H. J. McKellops, St. Louis.

GEORGE H. CUSHING, *Recording Secretary.*

The President appointed Dr. J. N. Crouse as Treasurer *pro tem.*, and announced the filling of a vacancy in the Executive Committee by the appointment of Dr. Louis Ottofy.

By unanimous consent the Constitution was suspended so far as relates to the work of the Joint Session.

The Executive Committee reported the programme for the Joint Session, as printed, which was unanimously adopted.

The Committee on Credentials made a partial report, which was adopted and subsequently completed as follows:

American Dental Society of Europe—I. B. Davenport.
Baltimore College of Dental Surgery—M. W. Foster.
Boston Dental College—J. A. Follett.
Chicago Dental Society—F. H. Gardiner, A. W. Harlan, G. S. Salomon, W. B. Ames, J. A. Swasey, W. W. Allport.
Chicago Dental Club—J. S. Marshall.
Chicago College of Dental Surgery—T. W. Brophy.
Dental College of University of Michigan—J. Taft.
Dental Department, State University of Iowa.—A. O. Hunt.
Dental Department of Harvard University—Thos. Fillebrown.
First District Dental Society of New York.—W. H Atkinson.
Illinois State Dental Society—Louis Ottofy, W. H. Taggart.
Iowa State Dental Association—F. R. Ross, A. W. McCandless.
Indiana State Dental Association—S. B. Brown, W. W. Shryock.
Kentucky State Dental Association—Francis Peabody, J. B. Alexander, A. W. Smith, J. F. Canine.
Kansas State Dental Association—C. B. Gunn, F. O. Hetrick, C. E. Esterly.
Michigan State Dental Association—N. S. Hoff.
Mississippi Valley Association of Dental Surgeons—L. E. Custer.
Missouri State Dental Association—W. H. Buckley, A. C. Griggs, W. E. Tucker, B. Q. Stevens, Wm. Conrad, J. W. Meng.
Missouri Dental College—A. H. Fuller.
Northwestern College of Dental Surgery—E. J. Perry.

Odontological Society of Chicago—George H. Cushing.
Odontological Society of Pennsylvania—W. Xavier Sudduth, James Truman.
Odontological Society of Cincinnati—O. N. Heise.
Odontographic Society of Chicago—D. C. Bacon.
Ohio State Dental Society—F. S. Maxwell.
Pennsylvania Association of Dental Surgeons—A. H. Sibley.
Pennsylvania College of Dental Surgery—C. N. Peirce.
Philadelphia Dental College—S. H Guilford.
St. Louis Dental Society—W. N. Morrison.
Texas Dental Association—W. R. Clifton.
University Dental College, Northwestern University—J. S. Marshall.
Vanderbilt University, Department of Dentistry—W. H. Morgan.
Washington City Dental Society—H. B. Noble.
Wisconsin State Dental Society—B. G. Maercklein

On motion of Dr. H. A. Smith, the President appointed the following Committee to draft resolutions in regard to the death of Dr. Geo. W. Keely, late Treasurer of the Association: Drs. H. A. Smith, E. T. Darby, and Geo. J. Friedrichs.

The Publication Committee made the following report, which was referred to the Executive Committee:

The Publication Committee would respectfully report that the Transactions were published by The S. S. White Dental Manufacturing Company, on the same terms as heretofore. The Committee are under renewed obligations to Mr. Hise, whose careful supervision and promptitude enabled them to offer the matter in excellent style and at an earlier date than usual.

The usual number of copies were printed, and bound in cloth.

The distribution was made as heretofore to active members whose dues were paid, to the libraries, universities, journals, and honorary members entitled to receive them. They were mailed about December 20.

RECEIPTS AND EXPENDITURES.

Received from Treasurer		$75.00
Expended for expressage, paper, and copying	$14.35	
" " printing notices and postal cards	5.50	
" " stationery, telegrams, circular letters, and postage	11.25	
" " S. S. White Dental Manufacturing Co.'s bill for binding, mailing, and postage	55.75	$86.85
Balance due the Committee		$11.85

GEORGE H. CUSHING, *Chairman.*

Audited and found correct,
August 28, 1888.
A. O. HUNT,
LOUIS OTTOFY,
Auditing Committee.

On motion, it was voted that when we adjourn we do so to meet at the call of the President.

On motion, the Treasurer was instructed to pay all properly authenticated bills.

Adjourned.

WEDNESDAY AFTERNOON.

The Association met at 3 P.M. at the call of the President, Dr. Abbott in the chair.

The minutes of Tuesday's meeting were read and approved.

The Committee on Credentials made a supplementary report, which was accepted as a report of progress.

The Auditing Committee reported as correct the report of the Publication Committee, and the bills of the Chairman of the Executive Committee for printing, postage, etc., and of Sections II and VI for printing.

A communication was then read from Dr. S. W. Dennis, of San Francisco, resigning his membership. On motion, the resignation was accepted.

A communication from the American Dental Society of Europe signed by W. R. Patton, Cologne, Germany, Secretary; W. St. Geo. Elliott, London; W. D. Miller, Berlin, and J. W. Crane, Paris, inviting the members of the Joint Session to attend the next meeting of that Society in Paris in 1889, was read in the Joint Session. On motion, the Corresponding Secretary was instructed to answer the invitation, in connection with the Corresponding Secretary of the Southern Dental Association.

On motion, it was ordered that the selection of the place of next meeting and the election of officers be made the special order for Thursday, at 1 P.M.

The Auditing Committee reported on state of the late Treasurer's accounts as follows:

LOUISVILLE, Aug. 29, 1888.

The Auditing Committee would report they have examined the books of the late Treasurer, Dr. G. W. Keely, and find all in good order; and there appears by the books to be the following condition of finances:

Received	$3759.64	
Amount not brought forward by the Treasurer	10.00	
		$3769.64
Expended	$2088.96	
Amount not brought forward by the Treasurer	7.50	
	2096.46	$2096.46
Amount as it appears on hand and due the Association		$1673.18

A. O. HUNT,
LOUIS OTTOFY,
Committee.

Adjourned to meet at 1 P.M., Thursday.

THURSDAY AFTERNOON.

The Association met at 1 P.M. pursuant to adjournment, President Abbott in the chair.

The minutes were read and approved.

The special order being the selection of place for next meeting and the election of officers, the Association proceeded to ballot for the place of meeting, the result of which was the selection of Saratoga.

The election of officers was then had, resulting as follows:

President—C. R. Butler, Cleveland, Ohio.
First Vice-President—A. W. Harlan, Chicago.
Second Vice-President—Samuel A. White, Savannah, Ga.
Corresponding Secretary—Fred. A. Levy, Orange, N. J.
Recording Secretary—Geo. H. Cushing, Chicago.
Treasurer—A. H. Fuller, St. Louis.
Executive Committee for Three Years—E. T. Darby, of Philadelphia; Geo. W. McElhaney, of Columbus, Ga., and J. N. Crouse, of Chicago.

Dr. A. W. Harlan at this point tendered his resignation as a member of the Executive Committee, and Dr. Frank Abbott was elected to fill his unexpired term.

Adjourned to meet at the call of the President.

FRIDAY AFTERNOON.

Pursuant to the call of the President the Association met at 1 P.M., the President, Dr. Abbott, in the chair.

The minutes were read and approved.

The Committee on Credentials made their final report, and the report as a whole was adopted.

The following resolutions, offered by Dr. Harlan, were adopted:

Resolved, That this Association extends to the Local Committee of Arrangements and the Executive Committee of the Southern Dental Association, the Reception Committee of the Kentucky State Dental Association, the Commercial Club, and the citizens of Louisville, its most hearty thanks for their assiduous attentions during its stay in Louisville.

Resolved, That to the railroads and to the hotels of the city the thanks of the Association are due for courtesies extended its members; and be it further

Resolved, That the special thanks of this Association are due Dr. Charles E. Dunn for the able, courteous, and thoughtful attentions he has given to the wants of its members, both before the meeting and during our sojourn in Louisville, and also to Dr. C. G. Edwards, for so pleasantly and ably seconding Dr. Dunn's efforts.

Resolved, That the Association is under grateful obligations to the School Board of the City of Louisville for the use of the Female High School building, whereby it has been so amply and pleasantly accommodated, and to the press of Louisville for their very excellent reports of the proceedings.

On motion of Dr. Cushing,

Resolved, That the American Dental Association desires to express to the Southern Dental Association its earnest, friendly greeting, and to assure them of its appreciation of the hospitality extended to its members, and it indulges the hope that the fraternal feeling engendered at the Joint Meeting may continue and increase to the end. And it would further assure them that its members have enjoyed themselves in the highest degree.

The Committee on Resolutions touching the death of Dr. Geo. W. Keely rendered their report (which will be found on the Memorial pages), and submitted the following resolution:

Resolved, That these resolutions be placed on a memorial page in the Transactions of this Association, and that a copy be properly engrossed and forwarded to his family.

H. A. SMITH,
EDWIN T. DARBY,
GEO. J. FRIEDRICHS.

The Committee on Necrology offered their report (see Memorial pages).

The Auditing Committee reported as approved the bill for expenses of the Joint Session, and an order for the amount, $44.63, was authorized to be drawn on the Treasurer.

On motion,

Resolved, That it is unprofessional to use on cards or signs anything except name, title, and address.

The following, offered by Dr. Taft, was adopted:

Resolved, That a Committee of three be appointed to take into consideration the feasibility of securing a complete Register of all dentists in the United States who have graduated from a regular Dental College, or who may have been licensed by a Board of Dental Examiners acting under law; said Committee to have discretionary power to proceed to the performance of this work so far as they may deem advisable, and that they be authorized to draw on the Treasurer for a sum not exceeding fifty dollars, to defray any absolutely necessary expense incurred in the work.

The President appointed as that Committee Drs. J. Taft, W. C. Barrett, and E. T. Darby.

The following letter was received, and the society therein named will hereafter receive the Transactions of the Association:

BOGOTA, November the 25th, 1887.

DR. FRANK ABBOTT, *President of the American Dental Association:*

SIR,—I have the honor to inform you that a Dental Society, the first one of its kind in this country, was organized in this city on the 28th of last February, with the name of "Sociedad Dental de Colombia."

The wishes of the members of this society are to establish mutual correspondence with the very honorable American Dental Association, over which you preside; and we hope that by the co-operation and friendly courtesy of that society the improvement of the dental art in this country will continue, the spirit of research be quickened and extended, and the profession advanced in self-respect, in public regard, and in usefulness.

The following gentlemen were elected officers for the year: G. Vargas Paredes, D.D.S., President; Eduardo Gaviria, D.D.S., Vice-President; Dr. Rafael Tamayo, First Secretary; Alejandro Salcedo, D.D.S., Second Secretary; Nicolas Rocha, D.D.S., Treasurer.

I have the honor to be, respectfully, yours,

G. VARGAS PAREDES, D.D.S.

The Sections were then organized, as follows:

SECTION I. Prosthetic Dentistry, Chemistry, and Metallurgy.—J. Rollo Knapp, chairman; W. B. Ames, secretary; F. S. Whitslar, N. J. Roberts, A. W. Freeman, M. L. Chaim, A. W. McCandless, Alonzo Boice, John Allen, B. Oscar Doyle, T. T. Hayward, T. S. Waters, M. B. Straight, D. E. Barrows, E. H. Allen, H. H. Keith, T. S. Hacker, W. S. How, C. B. Rohland, W. H. Dorrance, W. C. Dyer, B. Douglass, E. G. Douglass, M. H. Daily, M. W. Foster, E. S. Talbot, W. H. Taggart, W. E. Tucker, W. C. Wendel.

SECTION II. Dental Education, Literature, and Nomenclature.—W. H. Atkinson, chairman; Louis Ottofy, secretary; A. O. Hunt, Edgar Palmer, William H. Morgan, E. P. Keech, N. S. Hoff, M. V. Toledo, L. C. Ingersoll, George W. McElhaney, E. S. Holmes, J. N. Farrar, Charles H. Osgood, C. R. Jefferis, George R. Thomas, C. W. Lewis, H. B. Noble, J. N. Crouse, S. H. Guilford, Charles D. Cook, S. A. Freeman, W. W. Allport, S. B. Brown, J. Adams Bishop, C. F. W. Bödecker, E. A. Bogue, C. Bullock, Ira Brown, L. Balcom, C. S. Butler, A. E. Baldwin, Henry Cowie, James Cleland, C. E. Esterly, O. N. Heise, R. F. Horne, F. O. Hetrick, John S. Marshall, A. L. Northrop, E. Noyes, E. J. Perry, C. S. Stockton.

SECTION III. Operative Dentistry.—E. T. Darby, chairman; N. S. Hoff, secretary; C. N. Johnson, W. W. Shryock, C. H. Harroun, F. S. Maxwell, C. R. Butler, C. N. Peirce, Charles I. Keely, V. H. Jackson, W. N. Morrison, M. L. S. Buckner, W. H. Fundenberg, S. G. Stevens, W. F. Fundenberg, Eugene H. Smith, A. N. Priest, A. H. Fuller, Alonzo Boice, Henry Barnes, E. P. Hawes, W. H. Baird, B. F. Luckey, James McManus, Charles C. Barker, Thomas Fillebrown, B. Oscar Doyle, F. R. Ross, T. S. Waters, S. J. Hill, E. Honsinger, W. E. Page, G. W. Hoysradt, W. M. Shirley, E. S. Gaylord, J. N. Farrar, W. C. Stewart, A. H. Sibley, S. C. G. Watkins, M. B. Straight, C. A. Kingsbury, William Conrad, J. B. Alexander, R. B. Winder, D. E. Barrows, H. H. Jackson, F. Peabody, H. B. Noble, W. J. Martin, W. H. Buckley, W. A. Spaulding, M. F. Finley, A. H. Brockway, John V. Cole, Charles E. Dunn, Dwight M. Clapp, J. W. Rhone, George W. Melotte, S. B. Palmer, W. S. How, H. J. McKellops, W. H. Colgrove, W. P. Dickinson, Thomas T. Moore, E. C. Wadsworth, A. E. Brown, L. D. Shepard, E. P. Brown, W. R. Clifton, C. C. Chittenden, I. B. Davenport, A. F. Emminger, George L. Field, P. G. C. Hunt, R. F. Ludwig, B. G. Maercklein, Robert Maercklein, S. G. Perry, J. H. Smith, T. A. Wadsworth, T. E. Weeks, G. Knepper, J. W. Meng.

SECTION IV. Histology and Microscopy.—Frank Abbott, chairman; W. Xavier Sudduth, secretary; L. L. Davis, I. P. Wilson, H. W. Morgan, Thomas L. Gilmer, James G. Palmer, C. J. Peterson, W. C. Proctor, J. A. Robinson, F. A. Remington, E. D. Swain, A. F. Smith, B. Q. Stevens, A. H. Thompson.

SECTION V. Materia Medica and Therapeutics.—A. W. Harlan, chairman; James Truman, secretary; Charles P. Pruyn, W. H. Whitslar, Wilbur F. Litch, J. W. Palmer, E. D. Downs, C. A. Brackett, L. P. Bethel, A. M. Dudley, F. H. Gardiner, George D. Sitherwood, E. D. Nickson, S. E. Knowles, George H. Cushing, G. Knepper, D. E. Kelley, W. B. Knapp, Thomas C. Leiter, F. A. Levy, C. B. Rohland, J. A. Swasey, G. S. Salomon, J. W. Wassall.

SECTION VI. Physiology and Etiology.—H. A. Smith, chairman; A. H. Thompson, secretary; J. D. Patterson, L. E. Custer, George F. Waters, W. C. Barrett, W. P. Horton, A. Wilkes Smith, F. M. Odell, W. C. Wardlaw, W. S. How, Thomas T. Moore, George J. Friedrichs, E. L. Graves, C. B. Gunn, E. W. Munn, John W. Meng, A. R. Starr, M. E. Smith, James I. Taylor, Samuel A. White, J. C. Walton.

SECTION VII. Anatomy, Pathology, and Surgery.—T. W. Brophy, chairman; W. Xavier Sudduth, secretary; M. G. Jenison, M. L. Rhein, W. Wallace Walker, James M. Welch, W. C. Barrett, G. L. Curtis, D. C. Bacon, F. H. Gardiner, J. J. R. Patrick, William Carr, J. H. Martindale, J. W. Wassall.

The minutes were then read and approved, and the Chair appointed Drs. Harlan and Morrison to conduct the newly elected President to the chair, who in brief and well-chosen words thanked the Association for the honor conferred.

The President appointed as Committee on Publication, Drs. E. T. Darby and A. W. Harlan, and as Local Committee of Arrangements, Drs. W. W. Walker, New York, Chairman; S. A. Freeman, Buffalo; C. F. Rich, Saratoga.

The following amendments to the Constitution were proposed, which lie over for one year:

To amend Section 2 of Article III, by substituting the following:

SEC. 2. *Members losing connection with Local Societies.*—Any permanent member of this Association losing his membership in his local dental Society from any cause, shall from that date cease to be a member of this Association.

To amend Sec. 5, Article III, by adding at the close of the first sentence after the words "permanent membership" the words, "and who shall continue in the active practice of dentistry."

The minutes were then read and approved, and the Association adjourned to meet at Saratoga the first Tuesday in August, 1889.

GEO. H. CUSHING,
Recording Secretary.

MEMORIAL.

GEORGE W. KEELY, D.D.S.

It having pleased Almighty God, in whose hand is the breath of every living thing, to remove suddenly from the scene of his toils and honors our friend and associate, Geo. W. Keely, D.D.S.: therefore, be it

Resolved, As the sense of the American Dental Association, that in Dr. Keely's death this Association has lost one of its oldest and most honored members; a former President and for many years its Treasurer. Genial and urbane in disposition, kind and affectionate in his family, eminently successful in his calling, Dr. Keely was one whom we loved as a man and honored as a dentist. Ourselves marching to the eternal world, let us loiter for a moment on the busy highway of life to hang this garland on his grave.

It is with sadness and regret that your Committee have to report that within the last year there have been five of the active members of this Association removed by death, viz:

Dr. STODDARD DRIGGS, OF LEXINGTON, KY.

Dr. Driggs became a member of this body in 1864, and has since that time been an interested and earnest worker in and for the Association.

He was a noble member of the profession, one who never trailed its banner in the dust, but ever maintained its honor and dignity as becomes a true man. He always commanded in a very high degree the esteem and respect of all who knew him, and those who knew him best esteemed him most. He was a true gentleman, whose honor was unsullied.

The profession can ill afford to lose such men from its ranks, especially those in the heyday of life's work.

Dr. J. H. DEVORE, OF CORRY, PA.

Dr. Devore became a member of this Association at its meeting in August, 1883. He was an earnest worker for the profession, and of this body as well; one who sought to elevate the profession; furnishing an example that might well be imitated by all.

Dr. C. P. FITCH, OF NEW YORK.

Dr. Fitch became a member of this Association in 1860, at the meeting in Washington City, and was an active worker in its interest for many years. He was elected President of the body in 1866, in Boston. Dr. Fitch devoted the active years of his life to the elevation and upbuilding of his chosen profession and the promotion of the interests of this Association. He was for several years before his death compelled, by disease, to a life of quiet and inactivity; still he always had a warm solicitude for and interest in his chosen profession, the dignity and honor of which he was ever careful to maintain.

Dr. WILLIAM DUTCH, OF SAN FRANCISCO, CAL.

Dr. Dutch became a member of this body in 1872, and whenever practicable since that time has been present at the meetings. He was a man of a warm, genial nature, and was enthusiastic about whatever he became interested in. His

enthusiasm and energy doubtless were the occasion of over-work and exhaustion to such a degree as to unbalance his mind, and while in this condition he sought relief from life's troubles by a violent death. Such an occurrence impresses all with a peculiar sadness.

DR. GEORGE W. KEELY, OF OXFORD, O.

Dr. Keely's lamentable death occurred on the eve of this meeting, and having been reported upon by a special committee, need not be further mentioned here.

In these inscrutable providences we can only humbly submit to the privation, and put on record our grief and sense of loss, and extend our sympathy to all those who stand under the thickest part of this great cloud, and assure them that they do not sorrow alone.

MINUTES OF THE JOINT SESSION

OF THE

AMERICAN AND SOUTHERN

DENTAL ASSOCIATIONS,

HELD AT LOUISVILLE, KENTUCKY,

COMMENCING TUESDAY, AUGUST 28, 1888.

THE Joint Session was called to order at 11 A.M. by Dr. C. G. Edwards, of Louisville, Chairman of the Executive Committee of the Southern Dental Association, and the meeting was opened with prayer by the Rev. Mr. Muller.

Dr. Edwards then introduced the Hon. Charles D. Jacob, Mayor of Louisville, who welcomed the two Associations on behalf of its citizens.

He was followed by Dr. A. O. Rawls, who happily extended a cordial welcome from the profession.

Dr. E. T. Darby, of Philadelphia, was then introduced, who responded to the welcome of the Mayor, and Dr. J. Y. Crawford, of Nashville, responded to the address of Dr. Rawls.

After announcements by the two Presidents, the Joint Session adjourned to meet at 7.30 P.M.

FIRST DAY—EVENING SESSION.

The meeting was called to order by President Catching, of the Southern Dental Association, who, with some very complimentary remarks, introduced Dr. Frank Abbott, President of the American Dental Association.

Dr. Abbott then proceeded to read his address.

At the close of its reading he introduced Dr. B. H. Catching, the President of the Southern Dental Association.

Dr. Catching then read an address entitled, "Is the Average Dentist of To-Day a Specialist in Medicine?"

The last-named paper was then discussed by Drs. Jas. Truman, of Philadelphia; Roberts, of Illinois; Cushing, of Chicago; Thackston, of Virginia; Patrick, of Illinois; W. H. Morgan, of Nashville; Patterson, of Kansas City; Brophy, of Chicago; Crawford, of Nashville; A. Wilkes Smith, of Kentucky; Ottofy, of Chicago; Stockton, of New Jersey; Peirce, of Philadelphia; Sudduth, of Philadelphia; Wright, of South Carolina; Freeman, of Nashville; George J. Friedrichs, of New Orleans; Peabody, of Louisville; Carpenter, of Atlanta, and the discussion was closed by Catching, of Atlanta.

After various announcements, the meeting adjourned till 9 A.M. to-morrow.

SECOND DAY—MORNING SESSION.

The meeting was called to order at 9.30 A.M., President Catching in the chair.

An invitation from the Commercial Club, of Louisville, was read and on motion accepted.

The report of the Joint Committee on Operative Dentistry was presented by Dr. Darby.

Papers were then read, by W. Storer How, on "Dental Inlaying with Porcelain;" by J. J. R. Patrick, on "The Rationale of the Construction of Artificial Crowns for the Roots of Natural Teeth;" by C. E. Kells, Jr., on "Filling-Materials as Conductors of Heat and Cold," and by T. L. Gilmer, on "Artificial Crowns."

These were discussed by Drs. Genese, of Baltimore; Fillebrown, of Boston; Atkinson, of New York; Peirce, of Philadelphia; Kells, of New Orleans; Patrick, of Illinois; Allport, of Chicago; Freeman, of Nashville; Storey, of Texas; Cravens, of Indiana; W. H. Morgan, of Nashville; J. Taft, of Cincinnati; Darby, of Philadel-

phia; Patterson, of Kansas City, and James Truman, of Philadelphia.

After announcements by the Chair, adjourned till 8 P.M.

SECOND DAY—EVENING SESSION.

Meeting called to order at 8 P.M., President Abbott in the chair.

On motion, proceeded to the next order of business.

Prof. Abbott read the report of his Joint Committee.

Dr. I. P. Wilson, of Burlington, Iowa, read a paper on "The Apical Portion of the Cementum Physiologically and Pathologically Considered."

Discussed by Drs. Atkinson, of New York, and Storey, of Texas.

Dr. Abbott then read a paper entitled, "Odontoblasts in their Relation to Developing Dentine."

Discussed by Drs. Sudduth, of Philadelphia, Abbott, of New York, and Allport, of Chicago.

After announcements, adjourned till 9 A.M. to-morrow.

THIRD DAY—MORNING SESSION.

The meeting was called to order at 9.30 A.M., President Catching in the chair.

Dr. John C. Storey, of Texas, announced the report of the Joint Committee on Materia Medica and Therapeutics, stating that there were four papers to be read: one from Dr. A. C. Hugenschmidt, of Paris, France; one from Dr. L. G. Noel, of Nashville; one from Dr. Harlan, of Chicago; and a report of a case of cocaine poisoning by Dr. Storey, of Texas.

Dr. Storey read the report of the case of cocaine poisoning. Dr. Harlan read the paper on the "Hypodermic Use of Muriate of Cocaine in Oral and Dental Surgery," by Dr. Hugenschmidt. Dr. Noel read his paper on Materia Medica and Therapeutics, and was followed by Dr. Harlan with a paper on the same subject.

These were discussed by Drs. Genese, of Baltimore; Storey, of Texas; Marshall, of Chicago; Patterson, of Kansas City; Sudduth, of Philadelphia; Peabody, of Louisville; Patrick, of Illinois; Harroun, of Toledo; Ingersoll, of Iowa; W. H. Morgan, of Nashville; Staples, of Texas; and Rawls, of Kentucky.

Subject was passed.

The Joint Committee on Physiology and Etiology reported by Dr. H. A. Smith that the following papers were to be read: One by H. A. Smith on "Dental Implantation;" one by J. D. Patterson on "Points in the Etiology of Pyorrhea Alveolaris;" one by Louis Ottofy on "Incipiency of Dental Caries."

After announcements from the Chair, adjourned to meet at 7.30 P.M.

THIRD DAY—EVENING SESSION.

The meeting was called to order at 8 P.M., President Abbott in the chair.

Discussion on Dr. H. A. Smith's paper was postponed till the subject of Pathology and Surgery should be called.

Dr. Patterson's paper was then discussed by Drs. Genese, of Baltimore; Storey, of Texas; Marshall, of Chicago; Atkinson, of New York; Morrison, of St. Louis; Taft, of Cincinnati; and Friedrichs, of New Orleans.

The subject was passed to consider Dr. Ottofy's paper. There being no discussion upon it, the report of the Joint Committee on Anatomy, Pathology, and Surgery was read by Dr. Brophy, and Dr. Marshall, of Chicago, related a case of replanting of bone, and a hospital report of a fatal case of emphysematous gangrene from neglected alveolar abscess.

Subjects were discussed by Drs. Atkinson, of New York; Crawford, of Nashville; Patterson, of Kansas City; Sudduth, of Philadelphia; W. H. Morgan, of Nashville; Catching, of Atlanta; and Marshall, of Chicago.

After announcements from the Chair, adjourned to meet at 9 A.M. to-morrow.

FOURTH DAY—MORNING SESSION.

The meeting was called to order at 9.30 A.M., President Catching in the chair.

Before the regular order was resumed Dr. W. H. Richards, of Knoxville, Tennessee, exhibited and described an instrument for treating alveolar abscess, and Dr. Custer, of Dayton, Ohio, one for obtunding sensitive dentine.

The regular order being called, the discussion on Pathology and Surgery was continued by Drs. Marshall, of Chicago; Beach, of Clarksville, Tennessee; Abbott, of New York; W. H. Morgan, of Nashville; H. A. Smith, of Cincinnati; Sudduth, of Philadelphia; Peabody, of Louisville; Catching, of Atlanta; and J. Taft, of Cincinnati.

The subject was passed.

On motion, it was resolved that all remaining papers in the hands of the various Joint Committees be called and read before any further discussion takes place, and if time allows after the reading of the papers they shall be discussed in the order of presentation.

Dr. J. Rollo Knapp then read the report of the Joint Committee on Prosthetic Dentistry, Metallurgy, and Chemistry, and Dr. Genese read a paper on "Rubber and How to Use it."

The regular order was here suspended, and the following resolutions offered by Dr. Marshall, of Chicago, adopted:

WHEREAS, It is the sense and belief of the American Dental and the Southern Dental Associations, in Joint Meeting assembled, that the tariff on imported dental and surgical goods works a hardship upon the profession and the public: therefore, be it

Resolved, That we memorialize Congress to abolish all duties upon imported dental and surgical instruments, apparatus, and supplies.

Resolved, That the Secretaries of the Associations be instructed to forward this resolution to the proper authorities in Congress, and that each member of the Associations be requested to use his influence with the Congressman of his district to vote to place the above-mentioned goods upon the free list.

The regular order being resumed, the following papers were read:

One by Dr. Ottofy on "Dental Education;" one by Dr. Atkinson on "Physiology, Pathology, and Therapy;" one by B. Holly Smith, of Baltimore, on "Education," read by Dr. Taft; one by Dr. Ingersoll on "Methods in Dental College Education;" one by Dr. Stubblefield, of Nashville, on "The Dentist Yesterday, To-Day, and To-Morrow," and one by Dr. George J. Friedrichs on "Hygiene."

After the usual announcements, adjourned to meet at 7.30 P.M.

FOURTH DAY—EVENING SESSION.

The meeting was called to order at 8 P.M., President Abbott in the chair.

The papers read in the morning were called in the order in which they were presented.

Dr. Knapp's paper was discussed by Drs. Storey, of Texas, and Friedrichs, of New Orleans.

At this point an invitation by telegraph was received for the members of the Joint Assembly to attend the meeting of the Mississippi Valley Medical Society, and the Secretaries were instructed to return thanks for the courtesy extended.

Discussions being resumed, Dr. Ingersoll's paper was discussed by Drs. Ingersoll, Morgan, Catching, Guilford, and Taft; Dr. Stubblefield's paper by Dr. Atkinson, and Dr. Friedrichs's paper by Drs. Friedrichs, Atkinson, and Patrick.

Discussion was finally closed at 9.30 P.M.

After appropriate remarks from the Presidents of the two Associations, a resolution of thanks was tendered the retiring officers, Dr. Taft stating that it was largely due to the admirable manner in which they had presided that the Joint Meeting had been so successful.

The Joint Session then adjourned *sine die*.

GEORGE H. CUSHING,
Recording Secretary of the American Dental Association.

ANNUAL ADDRESS.

BY FRANK ABBOTT, PRESIDENT OF THE AMERICAN DENTAL ASSOCIATION.

GENTLEMEN:—We are again permitted by divine providence to meet in annual convention, to cultivate the acquaintance of our brethren socially, and to discuss professional subjects to the end that great good may result to the community at large. For these privileges, under these auspicious circumstances, we ought all to be particularly thankful.

It becomes my painful duty on this occasion to announce that during the past year our ranks have been thinned by the loss by death of five members of the American Dental Association, as follows:

Dr. Chauncy P. Fitch, of New York, a former President of this Association; Dr. Wm. Dutch, of San Francisco, Cal.; Dr. J. H. Devore, of Corry, Pa.; Dr. Stoddard Driggs, of Lexington, Ky.; and Dr. George W. Keely, of Oxford, Ohio, a former President and for several years past Treasurer of this Association.

The circumstances of the death of Dr. Keely, and occurring as it did, on the very eve of this meeting, which he, like the faithful officer he was, anticipated much pleasure in attending, render it fit and proper that early action be taken by the Association in reference to it, and such action conveyed to the sorrowing family and friends as soon as practicable. Dr. Keely was one of our oldest, most faithful, and most prominent members, universally beloved by all who knew him, a good dentist and an honest man. His loss will be greatly felt by this Association, and particularly by the older members.

The theme to which I shall ask your attention for a few moments is a brief review of the last ten years of scientific work in our specialty, in one particular line of study.

The superiority of the system of dental surgery as practiced in this country is so manifest and so universally conceded, that even comment is uncalled for.

The development of this specialty in medicine, as the result of the last fifty years' strife and labor, is, perhaps, unequaled by any other in this or any other country. This fact is forcibly illustrated by the number and generally good quality of schools devoted to the education of young men for its practice, as compared with those devoted to such teaching in countries supposed to be the seats of culture. It is further shown by the unparalleled increase of the literature upon dental and oral science, and the richness of practical devices, useful inventions, and improvements in methods of treatment.

The number of dental colleges in this country has increased so rapidly the past few years, that I am at a loss to state the exact number at this moment. I believe, however, that I am safe in placing the number at thirty, all more or less prosperous, and unquestionably aiming at the highest possible standard of education, both in theory and practice; and offering a vast amount of opportunity to students to learn how best to treat diseases of the oral cavity.

In Europe there are, except in England and in France, very few, if any, schools exclusively devoted to instruction in this branch of the healing art.

Berlin, the German capital, has a dental school, I believe, some three years old. Vienna, the capital of Austria, has no dental school proper. Just at present, however, efforts are being made to establish one there. In the course of a year, I presume, if its promoters are successful, it will be in working order.

The difficulty in the way of successfully inaugurating dental schools seems to be, especially on the European continent, their dependence upon universities, on the one hand, and the meddling of the governments with their administration on the other. In nearly all European countries, especially Germany and Austria, a great amount of preliminary education is required before a young man is admitted to a university. Then five years of hard work must be given to the study of medicine, before he can receive the degree of M.D. These, until quite recently, have been the preliminary steps to be taken before a specialty could be taken up. All that could be learned of dentistry was in a private office, where years had to be spent in order to become a dental doctor. Indeed, very few of those who had obtained the so-called academic degree were willing to devote their lifetime to the specialty of dental and oral surgery, it being considered rather an inferior calling for a highly educated medical man to pursue.

The very important branch of dental prosthesis is, even now, entirely in the hands of technically skilled but otherwise uneducated persons. Hence a curious division arises between the dentist proper and the dental technician. The former has a right to operate upon the natural teeth, to which special branch he devotes his energies, but is seldom inclined, or even capable, of making a piece of mechanical dentistry. Whenever in need of such work he is obliged to rely upon the technician, who, as such, is forbidden to practice "over the chair." The government, represented by the police,—meddling, as it were, with the whole community,—sharply superintends the movements of these dental mechanics; and woe to them if caught extracting a tooth even. It is quite different with us. The utmost liberality to all prevails in the choice of a profession or trade. If a profession is chosen, a good education is certainly desirable, and I am more than pleased to be able to say that to enter our *dental* schools, and many medical colleges, it is demanded; not that the student shall have attended so many years at a "gymnasium" or an academy, but that he must be able to *satisfactorily pass an examination* prescribed by those who are supposed to know what is needed. With these restrictions, a young man may enter upon any professional career he chooses, whether it be general practitioner, surgeon, gynecologist, or dentist. Besides a general education in a profession, which is always desirable, the main requirement is perfection in the branch selected, which is obtainable by attendance in a private office, in a hospital, or in a special school. To make a successful practitioner of the specialty of dental surgery, a fair general education, together with a good deal of brains, a vast amount of manual skill, and sound judgment are essential. We insist upon a knowledge of anatomy, physiology, chemistry, pathology, and therapeutics; but we lay particular stress upon the all-important knowledge—as we look upon it—which enables the student to do independent work, both surgical and prosthetic, and do it well.

With this principle, and our individual and corporate independence, our dental schools have become prosperous and useful. Thus we explain the fact that a goodly number of young men flock to our colleges from different European countries, seeking, together with a superior theoretical, a more thorough practical knowledge of the proper management of diseases of the teeth and mouth than it is possible to obtain elsewhere, besides studying the devices for supplying artificial substitutes for lost teeth, for correcting deformities, etc.

While the generation of dentists just passing from the active field

of labor, for the most part, obtained their professional education in the offices of practitioners, the present or coming generation is nearly all college-educated, enjoying advantages far in advance of their elder brethren. So deeply-rooted in the minds of the people has become the conviction of the necessity for a thorough education, that in most of our States there are stringent laws enacted by their legislatures, which compel every one who wishes to practice to first graduate from some reputable college, or pass a satisfactory examination before a Board of State Examiners.

"We are an inventive people," is a remark often heard with pride, not only from our own people, but from people the world over. Dentistry has shared the profits accruing from the inventive genius of Americans; but from the zeal for improvement and perfection no little harm has, in my judgment, resulted in many cases by overdoing the work of superintending the dentures of the young. I allude more particularly to the removal of certain teeth, or the filing or grinding away of portions of teeth, for the alleged purpose of making room, and thus preventing early and destructive caries. Too much, in my judgment, cannot be said in condemnation of such practice as a rule. It is true that under some circumstances it is undoubtedly good practice, but they are exceptional cases. This brings us to the very foundation of all rational practice of dental surgery, viz, that of education, experience, sound judgment, and, last but not least, honesty.

An ingenious and useful operation in our specialty has, within the past eighteen months, been brought prominently to the attention of the profession by its originator, Dr. Younger, of San Francisco. I had hoped ere this to have had the pleasure of looking upon the operation of "implanting teeth" as an unqualified success, so far as certain conditions after the operation, and its permanency, were concerned; but, in the opinion of our most expert microscopists, who have carefully studied several implanted teeth after their removal, this has not yet been accomplished. In all cases thus far examined, absorption of the roots of the teeth has taken place after a lapse of from three or four months to two years, leading to the loosening and final loss of the tooth. The warning voices heard at the outset of this operation would seem from this to have been timely. The apparent difficulties, however, which now seem to militate against the permanency of the operation, may and we earnestly hope will soon be overcome. The man who has the courage and ingenuity to originate and perform such an operation as this will never be satisfied

until the success is complete in every particular. This is one of many operations constantly being done by dental surgeons in this country, of so brilliant a nature that we feel a just pride in their achievements. It has been thought and expressed by some that so much meddling of American dentists with the teeth of the people would finally lead to a complete destruction of the dentures of coming generations, so much so that the third or fourth generation hence will have degenerated to the genus "edentata." Just the reverse, however, seems to be the fact. A large percentage of those who have their teeth properly cared for enjoy better and stronger teeth than did their parents or grandparents before them. I venture the assertion that in no other country in the world can so many well-cared-for and perfect dentures be found in the mouths of the same class of people as in America. This beautiful and health-promoting result has been brought about through the education of the people by *educated dentists.*

It is not a little gratifying to us that while the practical work of our specialty has reached such a high degree of perfection, the scientific or theoretical part has by no means been neglected. The efforts made in the last ten years to elucidate the minute structure of the teeth, their histology and pathology, have resulted in the obtaining of much practically useful knowledge. I will, I feel sure, be pardoned for calling your attention to this most interesting and instructive branch of our education, as it has occupied nearly all of my leisure time for the past ten years. The new views and actual knowledge obtained, based upon microscopical research, are so utterly at variance with those held previously, that I deem it not only justifiable, but advisable, to bring them before this erudite body, though only in a condensed form. One can, unquestionably, be a good practitioner without possessing more knowledge of the anatomy of the teeth than that they are built up of dentine, enamel, and cementum, representing the hard tissues, and pulp and pericementum the soft; but I doubt if any practitioner can aim too high in his efforts to become acquainted with the intrinsic construction of the tissues of the organs he is so constantly operating upon. Does any one doubt that teeth are living organs, and as thoroughly nourished as any others of the body? We see them originating, and trace their development from the sixth week of embryonal life to the end, in both the temporary and permanent sets. We study, with the naked eye, their anomalies in number, color, consistence, and shape. From personal experience we know that operations

upon the teeth are extremely painful. Sensation is a property of living tissue only, and this alone will suffice to prove to an unbiased mind that the tissues of a tooth—particularly the dentine—are endowed with properties of life. The question then naturally arises, Where is this life located?

It is plainly understood by every one that neither the lime-salts nor the matrix—the glue-yielding basis-substance—can be the seat of life. Consequently, in the old methods of preparing specimens—drying and grinding—no signs of life were discernible; nothing but a lifeless frame-work, as it were, of a tissue once full of life, was to be seen. Fortunately, those old and, as we now think, almost useless methods are fast dying out, and being replaced by more modern and rational ones, viz, those which aim at preserving intact all the organic portions of hard tissues of whatever nature.

The knowledge obtained by the older writers was through these old methods, and, unfortunately, the conclusions they arrived at are still indorsed by many, not in this country alone, but in England and Germany, countries considered the cradles of histology.

The proper manner for obtaining an insight into the intricate structure of dentine and cementum is to keep the specimens perfectly wet while they are being prepared. In order to do this, immediately upon the removal of teeth from the mouth they are placed in a solution of chromic acid, which dissolves out the lime-salts and preserves the matrix—basis-substance—and its contents without material change. By this method, C. F. W. Bödecker succeeded in demonstrating, ten years ago, that the contents of the dentinal canaliculi, known as "Tomes's fibers," are formations of living matter. This he emphasized by the use of staining reagents, such as solutions of carmine, chloride of gold, osmic acid, etc., by means of which living matter in other tissues is rendered distinct from adjacent parts. The conical offshoots, emanating from the periphery of the dentinal fibers, were shown to penetrate light spaces in the basis-substance, which forms a net-like arrangement throughout the dentine; thus demonstrating almost to a certainty that the whole basis-substance of the dentine is pervaded by living tissue. The certainty of these conclusions has finally been reached by new methods, adopted by William Carr, of New York, who, at his early convenience, proposes to lay the results of his studies before the profession. The dentine, therefore, proves to be analogous to other varieties of connective tissue, such as bone, cartilage, etc., in accordance with the views announced in 1873 by C. Heitzmann.

In this view, not only the so-called cells and their offshoots, such as the dentinal fibers, are the centers of life, but the whole basis-substance—hitherto considered inert, as it was a product of secretion of the cells—is proved to be endowed with properties of life, or, speaking more concisely, traversed by living matter. In Europe there is, up to the present day, but one authority in the line of microscopical research, namely, S. Stricker, of Vienna, who has fully adopted this view. It is, of course, in very pronounced opposition to the cell theory. Many botanists, however, both German and English, have of late conclusively proved that the so-called cells of plants are by no means individuals, but are all interconnected by offshoots traversing the basis-substance,—known in plants by the terms cellulose, cement-substance, etc.,—thus establishing an uninterrupted continuity of living matter from the most remote points of the roots to the very tip-ends of the leaves, the same as Heitzmann claims exists in animals.

The so-called bioplasson theory having been established as regards the structure of dentine, bore fruit almost immediately as regards the pathology of this tissue. It was shown in 1879 that in the process of caries of dentine—provided a living tooth be affected—a reaction takes place which we know as an inflammatory process in bone-tissue, and, although several microscopists have contradicted these assertions regarding the process of caries, attributing the destruction of teeth by this process to the invasion of micro-organisms and the chemical changes brought about by their presence, without any participation of the living dentinal tissue, I still hold to the same views as then announced, with no material modification, after having repeatedly reviewed the ground then gone over.

The formation of secondary dentine, which is partly a physiological and partly a pathological process, has been elucidated by Bödecker, who has also demonstrated the process of primary inflammation in dentine, called by him ebonitis. He demonstrated that in this process a reduction of perfected dentine into its embryonal condition takes place, and that from this, in turn, a new tissue, osteo-dentine, arises. This is of the greatest importance to the practitioner, since it is the outcome of every irritation caused by the carious process, and since it is stopped or brought to a stand-still by the sealing of cavities—by filling—from moisture, particles of food, micro-organisms, etc.

Another important portion of the tooth, certainly to the possessor, has been the occasion of more discussion as to its structure than

even dentine, viz, enamel. For a number of years it has been a mooted question whether enamel is a mere deposition of lime-salts, or a tissue supplied with life and nutrition. Bödecker demonstrated, in 1878, that there are interstices between the enamel-prisms, and that these interstices hold extremely delicate fibrils of living matter, beaded in appearance, and sending offshoots into the prisms themselves, causing the transverse striations of the prisms, called after their discoverer the "striæ of Retzius." The square fields caused by these transverse striations were shown to hold a delicate, light reticulum, also supposed to contain tenants of living matter. At that time it was proved, on two of my own specimens, that, after a complete decalcification of the enamel, a distinct frill or reticulum is left, similar to that in any other variety of basis-substance, a portion of which was no doubt living matter. The great difficulty in studying the minute anatomy of the enamel lies in the fact that we cannot soften it to a degree sufficient to admit of its being cut. We must, therefore, resort to a process of grinding, which we do, taking the precaution to keep the tooth, from the time of its removal from the mouth until the mounting of the specimen produced, under water. If a thin slab of enamel be deprived of its lime-salts by means of a six per cent. solution of acetic acid, as proposed by Dr. G. W. Weld, a gradual dissolving of the prisms is observed, and the subsequent treatment with chloride of gold affords excellent means, to me, by which the presence of living matter in this tissue may be demonstrated.

I am, therefore, after ten years of careful study, thoroughly convinced that enamel is possessed of living tissue; the amount must, of course, be very small. This conviction, I am sorry to say, is shared by but few microscopists as yet, but I am always hopeful, and believe the time is not far distant when it will be generally received as a settled fact.

The pathology of this tissue likewise furnishes strong proofs of its life. This I have demonstrated in the process of caries, where a partial reduction of the enamel into its embryonal condition takes place. I have further demonstrated that pigmentation (incomplete calcification) of this tissue shows a markedly distinct reticulum, and that stratification, anomalies in the course of the prisms, excess of club-shaped spaces, etc., are the result of faulty development, and, as such, prove the life of the enamel-tissue.

The third hard tissue, the minute structure of which has been elucidated within the past ten years, is cementum. Bödecker found

it identical with bone-tissue in every respect: its lacunæ and canaliculi hold formations of protoplasm, partly living matter, and the whole portion known as inter-cellular or basis-structure contains living matter the same as other bone-tissue. In necrosis the shrinkage of protoplasm is a characteristic feature of the death of the tissue. In cementitis the cement-corpuscles, as well as the basis-substance, break up into medullary or inflammatory corpuscles, after a complete dissolution of the lime-salts; the final result being either an augmentation of the tissue resulting in a so-called hyperplasia, hyperostosis, or a disintegration into pus-corpuscles, with a more or less complete destruction of the cementum, such as we see in long-standing pyorrhea alveolaris and alveolar abscess.

Similar results, as to final destruction of the cementum, appear to be present in the absorption of the roots of temporary teeth, the granulation-tissue appearing to grow into the cementum, taking the place of the lime-salts which have been removed by a physiological irritant. In connection with the development of the cementum, a large number of anomalies are known to occur, which I have attempted to bring into a system.

An important outcome of my studies is an overwhelming evidence that, no matter what the anomalous shapes, or to what extent this tissue may be augmented, it is still filled with living matter. This is, in our conviction, continuous, both in its physiological and pathological conditions, with that of the pericementum on the one hand and that of the dentine on the other. Even though the pulp be destroyed, a certain amount of vitality is left in the cementum, nourishment being furnished it through the pericementum. This accounts for the fact that a pulpless tooth may be retained and be useful almost indefinitely, provided it has an opponent.

One of the most fascinating and I may say puzzling studies in our department is the history of the development of teeth, which has been most carefully studied by Heitzmann and Bödecker for the past eight years. Excellent workers have made attempts to clear up this topic for many years past without reaching a solution of the puzzle. Huxley, as early as 1859, announced the impossibility of settling this question on the ground of the cell theory. The greatest difficulty has always been to explain the origin of the enamel-organ from a previous epithelial structure, such as, unquestionably, the first trace of the organ is. The second stumbling-block has always been the question, "How are the odontoblasts on the periphery of the papilla transformed into dentine proper?" The researches

before alluded to have given evidence of the fact that the epithelial tissue of the cord is transformed into the myxomatous of the enamel-organ, which, as such, has ceased to be epithelial in nature, and is stored-up material for the formation of the future enamel. It was shown that this myxomatous tissue is the matrix of ameloblasts, which themselves are not directly converted into enamel-rods, but break up into rows of medullary corpuscles, which, after being infiltrated with lime-salts, build up the substance of the enamel itself.

In the development of dentine the same transformation takes place, first from medullary elements of the papilla into odontoblasts, and from these back again into medullary tissue, which, as such, receives the lime-salts and thus becomes dentine. The dentine-fibers are visible between the medullary corpuscles, which are receiving or to receive the lime-salts, although originally attached to and connected with the odontoblasts. Both ameloblasts and odontoblasts, according to this view, are merely provisional formations.

Both the enamel and dentine are the direct product of embryonal elements, the same as are all other varieties of tissues of the animal organism.

Whereas the *cell* theory considered the cells as stable and unchangeable formations, the *bioplasson* theory suggests a continuous oscillation of the form elements, or continuous ups and downs in their appearance, until a certain tissue is perfected. This same process of oscillation takes place in all pathological conditions, for the benefit of newly-formed tissues, the so-called hyperplasias, tumors, hyperostoses, or entirely new tissues, such as vaso-dentine and osteo-dentine. Researches comparatively so novel and of such an extremely delicate nature, requiring so much patience, so much technique, and such an experienced eye, are, as you can readily understand, not easily brought to the clear comprehension of every tyro in medicine or any of its specialties. We are, however, greatly pleased to see such a growing tendency, particularly among young men in this country, to do original work in this line of science. There are already in many of our dental schools chairs devoted to the department of microscopical anatomy of the teeth. In the last ten years a number of earnest workers in this country have published the results of their researches, and, although they do not fully agree with our views, they still are deserving of great credit for the hard work they have done for our general information. Among them I will mention Andrews, Black, Sudduth, Williams, and Stowell.

With the antique cell theory no accurate understanding of the

minute anatomy of any tissue of the body was to me possible. Beyond the proof of the presence of cells and their derivations, no efforts had been made to localize the life and the physiology of the tissues. Now we know that properties of life are present, not only in the so-called cells, but in the inter-cellular substance, hitherto supposed to be entirely inert.

Let us hope that the time is not far distant when the results of the researches made in this country will meet with the approval of at least a majority of microscopists the world over. What we are striving for is originality and independence of old countries. To the superiority of our specialty in its practical aspect we hope will sooner or later be added superiority in the scientific departments.

ADDRESS.

By B. H. CATCHING, President of the Southern Dental Association.

Is the Average Dentist of To-day a Specialist in Medicine?

THE question before us is not to determine the relation of dentistry to medicine. That has never been a question with the intelligent dentist, nor with the well-informed practitioner of general medicine.

It required not a formal declaration on the part of the medical profession to establish this relation. The very objects and purposes of dentistry, as practiced by those competent, denote this. But unfortunately, the number who practice it as specialists of medicine is small as compared to the number who follow it as a trade.

To the professional class belongs whatever of honor or distinction dentistry has attained.

That the question of our relation to medicine has been asked and even discussed, is not strange, when we consider the great disparity in numbers between those who study and practice it as a profession and those who follow it as a trade.

From the latter class has gone forth the impression of the relation existing between profession and trade. In fact, were it not for the comparatively few who demonstrate by practice the relation existing, there could not be found any relation at all.

He who builds a bridge, and welds gold, and feels that with a bottle of creasote or carbolic acid he has reached the highest professional standard, has no conception of the possibilities of his calling.

That is the average dentist of to-day,—proficient in that which goes to make the artisan, but deficient in that which makes the specialist in medicine.

Why, then, should we be surprised that public opinion has caught

the idea of our indefinite relation to the medical science? Public opinion is slow to form, but when once formed it becomes despotic. We have labored under this despotism ever since we created a separate existence, and so long as we continue the separation, so long will our relation be disputed.

I am not here to condemn the non-professional class, but to sympathize with them, for I think a large majority of them are not so from choice, but because of the system under which they were educated. The average man will not rise above his surroundings nor forget his training. They were not taught in a manner to cause them to look above a trade level, or to appreciate their work as noble and elevating. They were not taught the proud principles and truths of the healing art. They were not taught to feel their equality with other specialists, but rather to feel an ignoble inferiority, even to those whose callings are not more worthy nor more elevating. They were not taught dental surgery in the highest conception of the term, but were taught to view the mechanical as the proper basis and highest plane of professional existence.

Such is the limited education of the average dentist of to-day. Don't condemn them, but condemn a system too narrow for the higher purposes in life; a system so contracted as to give only the lowest conceptions of the possibilities of a calling ranked as one of the three learned professions. If we are to appreciate our opportunities, advantages, and possibilities, we cannot continue a plan so deficient in that which relates to professional life.

Our usefulness is not less, but greater than that of some specialties now listed honorably on the professional calendar. That we have not occupied our proper relation before the world is because of our separate and limited system of education. To condemn a system which has been for half a century operative, may be thought by some, to say the least, unwise. But wisdom lies in the path of progress and improvement. The advancement now taking place in all relations of life must cause us to keep pace.

For fifty years we have mixed a little of medicine with a little of mechanics, issuing forth, not versed in that which gives us rank and not fully qualified in that which makes our specialty distinctive. Making a dual relation of a single existence has been to our harm.

I do not come to persuade those who are satisfied with the trade idea, for they are past redemption. I do not come to persuade those who, when this question is mentioned, cry out, "Great is Diana, the god of the Ephesians," for they are co-workers with Demetrius.

I do not come to persuade those who have attained to the highest pinnacle of fame without colleges or books; for they were born great.

But I do come to persuade those who feel the responsibility of a specialty in medicine resting upon them.

Tell me that dentistry is a specialty in medicine, and yet tell me, as I have heard on the floors of debate, that a medical education is not necessary to practice it as such,—that which is the very foundation of the science?

None have risen to distinction possessing only the knowledge necessary for the degree of D.D.S. Many have risen, who, possessing the degree, realized its limited sphere and reached out for that which leads to greater possibilities—a thorough medical education. These stand to-day as leaders in the profession, and upon such must rest the honor of advance in dental science.

I need no better argument for the importance of medical education than to point to the medical degree of our college presidents and professors. He who is my associate on this occasion, a proud dean of a dental college, boasts of no other degree. That which he confers on his graduates he deems not worthy of his own use. I applaud him for his wisdom of choice. I feel that in those who have obtained the honorable and only legitimate title in medicine, I must find supporters for my position. It is the only degree known in medicine; the only one that will entitle us to rank in that noble calling; the only degree that conveys the full privilege of medicine and surgery; it is the only degree that can protect even the dentist in serious results of surgical operations. The law will not hold him blameless who essays, without this degree, to perform operations from which evil results follow.

Our peculiar and recently acknowledged relation to medicine must be carefully considered.

The idea of advancement is abroad in the land. I do not suppose a presidential address ever struck a more popular chord than did that of the late president of the American Medical Association, the lamented Dr. Garnett. The demand is for higher qualifications, a broader curriculum, and an extension of time. The idea of equipping students for so grave and responsible a calling in two short terms seems to have come suddenly upon the masses as a thing most absurd. So, claiming for our specialty an advance in both time and studies, we lay no claim to following suit. For years this has been the uppermost question before us. We have, by the enactment of

rigid State laws, shown the conductors of our educational system our disapproval of turning loose hordes of graduates without either natural or acquired qualifications.

The place to guard the sacred precincts of professional life should be at the college doors. Instead we have had to make the line at State borders.

The rapidly multiplying number of schools induces a scramble for matriculates much more befitting a stock exchange than institutions of learning.

I cannot but view this increase of schools with alarm. They are not created because of necessity, for necessity does not exist. They are not created for higher aims and purposes, for their acts do not proclaim it. Then why are they created? Sometimes through jealousy, sometimes for personal preferment. I think more often a better solution is found in the domineering of the trade over the professional spirit.

Tradesmen are not slow to catch the idea of a college here and a college there, believing that the more colleges more students, more trade, which is a legitimate trade principle, but one very detrimental to professional interests. The full solution is found in personal preferment and mercantile interests.

In considering this matter in the light of professional advancement, we are brought face to face with the domineering tendency of the trade concerns of the country, and the patent office relation existing between them. I sometimes compare our situation to that masterpiece in art, the "Laocöon." By State laws we threw off the college domination. But there is now upon us this gigantic "trust," which is grinding at the very foundation of professional liberty. Does it not pull down that which we are trying to build up?

The trade idea is encouraged in our ranks, the love of the patent office is fostered, until they have become enemies to true professional dignity.

The average dentist views these as legitimately professional. The medical profession has its Gross, its Sims, its Dalton, but the dental profession has him who made the highest type of operative dentistry possible. Without him, difficulty would stare us in the face and defeat would crown every effort; with him, victory is ours. He left us a legacy that we shall never exhaust, a blessing that shall never end. I allude to Dr. Barnum. Would that his spirit could pervade many of our hearts.

How my very nature did rebel when, before one of the oldest

dental societies of the world, a tradesman read a paper declaring the patent office and the manufacturing establishments to have been the greatest factors in our progress. Without this noble gift of Barnum's scarcely one of his patents would be useful. And how my pride was cut when not a single man of that association rose to dispute the assertions.

If they are the truth, then what have we been doing in the way of education? I feel that I have not digressed, because these facts relate to our moral status as a profession, and if the average dentist is taught to view them in their true light, he will be the better and dentistry will be made more honorable.

The relation of dentistry to medicine is that of general surgery. The surgical part of our specialty is its distinctive feature. The general surgeon is master of the medical science in so far as it is taught in the medical schools. The gynecologist is master of the science of medicine in so far as it is taught in the medical schools. The ophthalmologist is master of the medical science in so far as it is taught in the medical schools, so with the otologist, the dermatologist, the laryngologist. But the dental surgeon is not master of the medical science, because he is not taught in the medical schools.

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Are you willing to accord more to other specialists than to dental surgeons? Do you rank its importance as less than that of other specialties? If so, then you may well be content with our separate system of education.

He who cannot see the advantages of an intimate associate relationship of dental surgery to medicine, must be blinded by the darkness of bigotry.

Now that the relationship has been defined by the highest medical tribunal in the land, we should set about to qualify for an intimate existence. I do not believe an extension of time under the present system would accomplish what we need or meet the demands placed upon us by an exacting, educated public. We must adopt that system which will educate us in the science of medicine and perfect us in the art of dentistry.

To do this we must convert the infirmaries of our dental schools into the highest and most comprehensive oral infirmaries, in which the masters shall teach from the construction of a rubber denture to the finest bridge-work; from the simplest filling to the most elaborate; from the extraction of a tooth to the exsection of a maxillary. The qualification for admission to these infirmaries should be the

degree of Doctor of Medicine, conferred by a reputable medical college.

The transition from the present to the proposed system would be easy. It would materially elevate the standard of education, besides lengthening the time, thereby decreasing the number of matriculates. Besides, a number of the already existing infirmaries would have to close on account of not being able to instruct in the highest type of dental art.

The present system, with the increased number of schools and the rapid advance in the dental art, has made post-graduate schools a necessity. The need for them is now so great that their creation cannot much longer be deferred. Post-graduate schools would mean the downfall of the present system.

The system I propose may be called idealistic. It is sure to be realistic, and then the average dentist will be a specialist in medicine.

DISCUSSION.

DR. JAMES TRUMAN, of Philadelphia: I dislike to appear in antagonism to so ably written a paper as the one just presented, but there are some points in it that seem to me to require notice. I do not agree with the essayist that it is so absolutely essential that dentists should have the M.D. degree. My opinion is that we can practice separately under the D.D.S., and with as much satisfaction as we can under the so-called higher degree. From an experience of a quarter of a century in teaching, I am led to believe it is hardly possible to make good dentists out of medical men [applause]. It is an error, in my opinion, to suppose that we can begin a practical education at the top, when a man has to acquire an education of the fingers as well as an education of the mind. If he begins at the top of the ladder he will never go down to the lower round satisfactorily. Such is my experience with all medically educated men: they never make what I call good dentists. I do not say it is absolutely impossible. It will depend largely upon the character of the individual, but as a rule medically educated men cannot come down to details in practical and mechanical matters. I think if we could all take the medical degree *after* a thorough course in dentistry it would be well. I object to its being promulgated here that a doctor of dental surgery cannot perform a surgical operation without being called by the law to suffer if anything happens deleterious to the individual. I do not know of any such law in this land or any other where the D.D.S. degree is recognized. I have

been time and again a witness in such cases, and the courts have always sustained the degree.

DR. ROBERTS, of Waukegan, Ill.: Will Prof. Truman please state where the law will draw the line between the dentist and the surgeon as to responsibility, if a dental surgeon is not held responsible for the results of surgical operations in the mouth?

DR. TRUMAN: I do not know anything about such a law.

DR. ROBERTS: As I understand it, the law does not uphold the dentist who performs a surgical operation provided it is anything more than extracting a tooth.

DR. TRUMAN: I do not quite understand the doctor. Does he mean to say that the dentist has no right to perform any operation in the mouth except extracting teeth?

DR. ROBERTS: I do not say he has no right to. I ask if a surgical operation is performed by a dentist in the mouth, how far can he proceed and still be protected by the law? If he is a physician he can follow out the treatment to the end. Would the law hold the dentist responsible if bad results followed his operations? I would like to know where we can look for protection if we do not take the degree M.D. The law gives us no definite line.

DR. CUSHING, of Chicago: I do not think the law has much to do with determining the diploma a man must hold. If he makes a mistake, whether he have the degree of M.D. or D.D.S., it will hold him responsible. If he does not make a mistake there will be nothing to hold him responsible for.

DR. THACKSTON, of Farmville, Va.: Some of the grandest and most brilliant operations which have illustrated the superiority of American surgery have been performed by dentists holding only the degree of D.D.S., and it is only necessary for me to remind you of Dr. Hullihen, of Wheeling. One of the most difficult and formidable operations known in surgery was performed by him, and he was sustained not only by the laws of the land, but received the grateful acknowledgment of surgeons, physicians, dentists, and the parties interested. That was only one of a number of important surgical operations that have been performed by dentists, and in all instances where dental talent has been employed in the performance of formidable surgical operations there has been no attempt at prosecution or effort made either by physicians, surgeons, or the ministers of the law to prevent their performance.*

* See *American Journal Dental Science*, 1st series, vol. ix, page 157.—T.

DR. PATRICK, of Belleville, Ill.: The question was asked where the line should be drawn. I take it for granted that the law and common sense will not hold a man blameless who is guilty of malpractice, I do not care how many diplomas he may be in possession of. The line will be drawn by lawyers when you get into court, and it will be drawn in such a manner that no mathematician can follow it. A man in general practice is not protected in *mal*practice. It is his business to see that he is not guilty of malpractice, I don't care what portion of the human body he professes to treat.

DR. W. H. MORGAN, of Nashville, Tenn.: There are two points in that address to which I desire to call attention. The first one is the assumption that the degree of M.D. is a higher degree than that of D.D.S. That is a blank assumption, nothing more. The medical schools in the city of Louisville and the schools generally in this country require two courses of instruction. Sometimes they put on an addendum of a year's study, but they often do not investigate, so far as my knowledge goes, to see whether the student has studied a year before he enters college or not. At the end of two courses of five months each he gets his M.D. How is it in the dental schools? I believe there is not a single one in the country now that is of conceded reputation that does not give at least two courses of instruction of five months each, and I think their students are as faithfully taught as are those in any medical institution. The time of the students is as fully occupied, and they enter into their studies with as much earnestness as do those in the medical colleges. As a class dental students are more earnest, more energetic, and more enthusiastic in the pursuit of their studies than medical students.

The other point is the reference in the paper to what was termed the trade idea. Is not mechanics a science? Is it not the equal of any other science in the world? Is it not more positive than any of the sciences that are taught in medicine, except chemistry? Is not the man who can calculate the strength of that column and the weight it could bear as much a scientific man as the man who would give you a dose of calomel and tell you it would operate upon your liver, but he did not know how? The fact is that the science of mechanics is one of the highest in the world, because its truths can be demonstrated, while medicine as it is taught in the present day is to a very large extent a science of unascertained truths based upon theories that are plausible but not demonstrable. I have as high an appreciation of the medical profession as any man in this country; but medical men all know that these are facts, and I wished

to disabuse the mind of the President of the idea that every man who was a mechanic was a lower order of man than the man who pretends to understand medicine, and to claim for the scientific man in mechanics as much as can be claimed for the scientific man in any other branch of science. [Applause.]

DR. PATTERSON, of Kansas City: How far one holding the degree of D.D.S. is responsible, is a question of jurisprudence. If due skill and care have been observed according to the best knowledge which should govern, the law will not hold a man responsible for damages whether he is an M.D. or a D.D.S. This is a well-known rule of law.

I am sorry to see one who is professedly in favor of higher education for the dentist decry the multiplication of colleges for the dissemination of knowledge. It is certainly an inconsistent position. Knowledge is spread only in these ways, and when the writer intimates that the increased number of colleges is prompted by mercenary motives and comes from the "lower strata" in the profession, I think he is making a statement which cannot be substantiated and which I am sorry to hear made. I think the new dental colleges, as well as the old, have been originated and are carried on by those who are in favor of higher education.

DR. BROPHY, of Chicago: In answer to the question which was put by Dr. Roberts as to where the line should be drawn between the dentist who performed a surgical operation and a physician, I will say that any man who is educated in a special line of work has a right to engage in that work; and if he has had the education as a dentist that he should have, he will be prepared to follow up the treatment that would be required for the performance of any surgical operation such as he would undertake. I understand it that any man who has entered a school of dentistry and received instruction in surgery has a right under the charter of the institution and the diploma which he has received to practice anything that is taught him in that institution, and if he makes a mistake, as many gentlemen have said, he will be amenable to the law of the State in which he lives, just as an M.D. would be.

A word about what the gentleman has said of higher education. He said dentists should first be educated in medicine, and afterwards they should have a dental education, thereby becoming specialists in medicine. Only a few years ago I held precisely the same views he has advocated here this evening, but an experience extending over a number of years, and a trial under the most favorable circumstances that possibly could have existed, to

carry out his doctrine (which experiment was a signal failure), convinced me that such a system of education is utterly impracticable. To pursue such a course would not be in the direction of elevation, but rather the reverse, for as my friend has said we cannot change the line of thought of men whose minds have been trained in the study of medicine, and successfully get them down at once to dental ideas. Such men cannot be made as good dentists as those who are educated three years in the special line of study required to qualify one for the practice of dentistry. The dentist in taking up his study must have dental ideas inculcated from the beginning throughout his entire course. If the order be reversed, and after he has successfully completed his course in the dental school he then enters the medical school and graduates, he will unquestionably be the better dentist.

Dr. Crawford, of Nashville, Tenn.: I was in a dental society not long since, and I heard a man discussing the subject of prosthetic dentistry, and he said he had no use for the modern articulator. There have been some things said on the floor to-night as monstrous as that. The argument that familiarity with the fundamental branches of medicine, and proper and extended medical training, disqualify a man for any department of the healing art, in my estimation is absolutely monstrous. I am not speaking to-night simply to be heard. I am speaking in behalf of the profession especially,—the profession that I love. I tell you the doctrine antagonistic to the idea that dentistry is a specialty of medicine is the most dangerous doctrine that has been promulgated within a quarter of a century.

In my judgment, the saddest day in dentistry will be that on which the declaration shall be made by the entire profession that we are not a part of the grand whole. You tell me that a man, because he has taken a thorough course in medicine, is thus disqualified to utilize his knowledge in the treatement of disease of any portion of the organism? It is incompatible with common sense. It is repugnant to every law of logic, which should control in the discussion of an unsettled question. With reference to the matter of the extent of the jurisdiction of the dentist, you will find when that question is adjudicated that expert testimony, under the influence and direction of legal talent, will determine how far the dentist can go. So far as the two degrees are concerned, in that particular they are exactly upon a par.

Dr. A. Wilkes Smith, of Richmond, Ky.: In view of the fact that

two years ago the American Medical Association recognized the dental specialist, by adopting a resolution that those who had taken the degree of D.D.S. could become members of that body, I would ask what has occurred to cause so much feeling on the subject of the relations of the two. Have they snubbed us? Have they retired from the position they then occupied? In my opinion, a medical man can make a good dentist and a dentist can make a good medical man. We ought to reconcile these old matters of forty or fifty years ago.

DR. OTTOFY, of Chicago: According to the present conditions, the door is open for dentists to go in and be full-fledged medical men, with all the honors that medicine can confer. But we are doing more by what we injudiciously say and write to injure our own cause than in any other way. One of our most influential dental journals, within the last month, closed a very able article pleading for advanced education with the remarkable sentence that the dentist lays himself liable to prosecution whenever he performs the operation of implantation, if ill results should follow. If we are going to manufacture such a sentiment as that, what will the public permit us to do for them? I will ask you if implantation is not distinctly a dental operation? Yet you are told it is a surgical operation, and one of our most esteemed journals warns us not to perform it. I have tried to find out the limit of the legal right of dentists to perform surgical operations. I have written to the Boards of Health of Pennsylvania, New York, and Illinois, and in all three of these States the dentist is permitted to perform any operation which comes within the range of dental surgery. In case of ill results following an operation, no matter what his qualifications may be, the operator's position would not be a pleasant one.

DR. STOCKTON, of Newark, N. J.: Not very long ago, in a city in the South, a gentleman stopped at a hotel where there were a large number of guests, and he called out "Colonel," and every man in the house turned and answered, "Sir!" And so it is here to-night. Many of those present are professors in dental colleges, and it is therefore the unpopular side to antagonize their views, and I am not disposed to do it. I approve the course which Dr. Brophy very happily suggested. Dr. Truman said the idea was preposterous that you could take a man who had been educated at the top and bring him down to the dentist. No intelligent man ever thought of making a dentist in that way. The trouble with dental colleges to-day is that they take whomsoever comes, just as medical colleges

take them, without much previous preparation. If you put a man into a medical college to make a dentist of him, you will fail, because they have not the facilities and they do not train students in the use of the fingers first, as a dentist should be trained. I claim that a shoemaker will be a better shoemaker if he is a graduate of a college. You do not destroy his usefulness because you have given him a better education. A dentist should know not simply the anatomy and construction of a tooth, the formation of all the bones of the cranium, but he should know the whole man. An intelligent horse-shoer should not simply know the hoof upon which he is going to put the iron shoe, he should know the whole horse. And so it is with the man you are going to make a dentist of. Educate him in laboratory and office first, then he may go to a dental college; and then complete the work by graduation in a medical school, and you have a man fitted to begin the work of a dentist.

DR. PEIRCE, of Philadelphia: I have derived much pleasure and profit from listening to the addresses, and while I might find subjects for criticism in both I recognize an earnest desire for a higher education and greater attainments in our profession. It was Herbert Spencer, I think, who said that the secret of education was to study that which we most needed to know, and that was what my friend Prof. Truman meant when he spoke of the educated physician as not making a good dentist. His time and talent had been spread over a large field, and he did not devote himself to the one idea that was calculated to bring forth the highest class of dentistry. I have been a teacher for some years, and I know what advantage a student has who enters the profession with a determination to make it a success. He needs all that has a bearing upon his profession. The natural course as he progresses is to take in the collateral branches to the extent of his means, and our dental colleges I think offer opportunity for that. We certainly do at the Pennsylvania College of Dental Surgery, where we have the chairs of anatomy, physiology, chemistry, histology, and teach those collateral branches equally with medical schools. Indeed, our medical schools are glad to graduate our students after they have passed through our course of study, and have in the medical schools simply taken up the specialties of medicine that are not embraced in the dental curriculum.

In regard to the status of dentistry with medical men and in the courts. It was only last week that I witnessed an operation by a dentist in Philadelphia in the hospital, under the care of physicians. The operation was to have been performed by a regular surgeon, but he

was out of town, and the physician in charge sent for a dentist having only a D.D.S. to remove a tumor which had an attachment to the process of the lower jaw. The tumor was removed, the process was cut away and drilled out sufficiently to eradicate the disease. The same dentist I know has within the last three months successfully removed a large portion of the inferior maxillary of three different patients. In reference to the legal status of the operation, I might give you a little experience that I had in court as a witness in two cases, one against one of the ablest physicians in Philadelphia. The case was a prosecution for damages on a claim of malpractice. It came before one of our best judges, and after the prosecution had put in their evidence the judge ruled the case out of court. He said there was no evidence that the physician was not well educated and fully competent to perform the operation. Another case was where a dentist was prosecuted because inflammation and necrosis followed the extraction of a third molar. The judge said after hearing the prosecution that there was no evidence that the dentist had not been educated sufficiently to perform the operation, and therefore there could be no damages for the result. That I think would be the result in every court if it could be shown that the physician or the dentist had been properly educated and there was no evidence to show that the operation had been performed in an unskillful manner.

DR. SUPPLEE, of Philadelphia: As regards the legal aspect of the question, there can be no doubt that it would rest entirely upon the ability of the operator, which he must show at the time the case is called in court. Physicians have every opportunity to learn the [illegible] and treatment regarding surgical operations under their tutor and in the medical schools, but still suits for malpractice are constantly being brought against physicians, because it is supposed that it can be proved that the physician was not competent to perform the operation he undertook. If a dentist, no matter whether he has a degree of M.D. or D.D.S., is sued for malpractice, and he cannot show on the witness-stand that he has sufficient ability not only to perform the mechanical part of the operation but to treat the case all the way through, he will most assuredly be mulcted in damages. It is not a matter of degrees, but a matter of qualification. The point I would make is this: that in case a man holds only the degree of D.D.S. and performs surgical operations that were not taught in the college from which he graduated, a jury would be prejudiced against him from the start. If he could, how-

ever, on the witness-stand show that his skill and ability were such as to make him competent to handle such cases, he would overcome that prejudice. It is a matter of qualifications and not of degrees.

In regard to the point of education, I believe a dentist should be a dentist first, last, and all the time. He should commence the study of dentistry in the laboratory, he should learn mechanical operations, he should grasp all things that pertain to the routine of his practice, and gradually go on and add to that knowledge all of the collateral branches bearing relation to dentistry that his capacity of brain and physical ability are capable of. The more he knows, based upon a knowledge of the practical branches of dentistry, the better dentist he will be. I believe the only way is to commence as a dentist first. I told my friend Dr. Brophy some five years ago that I believed it was a mistake to try to train medically educated men as dentists, and so it was proved. A man who starts out in a school that has two courses, medicine and dentistry, and does not know which he is going to practice until he gets through and gets into practice, will make a sure failure; but if he starts out with the idea that he is going to be a dentist and takes his D.D.S. and then his M.D., he will make a better dentist. I believe dentally educated medical men are a failure as a rule, while medically educated dentists are better dentists than those who have not graduated in medicine after obtaining the dental degree.

Dr. Wright, of Columbia, S. C.: Referring to the matter of education, whether it be general medicine or dentistry, it may be said that the college student rarely acquires more than the faculty of learning how to learn. Few schools educate a man and qualify him to follow any vocation or fit him for every condition in which he may be placed. If he stops, whether it be in medicine or dentistry, where his college dismisses him with his diploma, that man is essentially a professional failure.

Dr. Freeman, of Nashville, Tenn.: As to the medico-legal standpoint, down in my section of the country the most eminent surgeons dare not hold property in their own names, because the settlement of such questions rests very much with the judge and jury.

The dental profession arose because of a necessity for it. It is a profession, and we call it a specialty because it is recognized the world over as a branch of the healing art, and specialties to-day are popular. To qualify men for the practice of this profession demanded a certain line of education, and those who followed it were called dentists. The medical profession sneered at them because medical

men did not know anything about the needs or qualifications of dentists. There are medical men in the land to day who cannot tell how many teeth there should be in the mouth. Now and then throughout the land some medical men of highest attainments would recognize men of talent and say, Come in: you are practicing the healing art; but the profession at large did not recognize us at all. Dentistry has grown of itself. We are as distinct a profession as any other. The community at large recognizes us, and I am proud that the D.D.S. is all-sufficient, although I, as was popular when I first started out, thought it desirable to have the M.D., and therefore I sought and received it. What we need is more colleges and a higher education, and the dental profession will do as much as the M.D.'s toward the relief of humanity.

DR. FRIEDRICHS, of New Orleans: The medical profession may recognize us as specialists in medicine, but the public will never recognize us as anything but dentists. It is taken for granted in the discussion here that if men receive an education in a dental college they can enter into practice accomplished artists in their special work. Now, I do not believe that a graduate of a dental school is quite so competent as that. He has only laid the groundwork, and it is only afterward that he will become an accomplished operator. The distinction between the dental degree and the medical degree is this, the doctor of medicine can practice dentistry and there is no law in the United States to prevent him. A dental surgeon cannot practice medicine. The public would not receive him as a medical practitioner even if he were competent, and I think the medical boards that now exist in the majority of the States would arrest as a quack one who should attempt to practice medicine unless he could show that he had a medical degree. But where is the authority of any board of dental examiners to interfere to prevent a man who has a degree of medicine from practicing the art of dentistry?

DR. PEABODY, of Louisville: I never knew a man to know too much unless it was of rascality, and why anyone should take the ground that we are capable of going backwards when we attain an additional amount of knowledge is something that I cannot understand. We have to practice medicine in our profession of dental surgery. Where is the gentleman in this State or elsewhere who has practiced for a term of years that has not given medicine for the alleviation of certain dental troubles? Is there a man in the South who has not used quinine to cure malarial toothache,

and simply by the aid of medicinal agents has relieved that pain and trouble? President Davis, of the American Medical Association, stated two years ago that any dental surgeon who had taken the course that the medical students are required to take, substituting dental medicine for general medicine, oral surgery for general surgery, would be recognized on the floor of the medical societies as one of them. The oculist, the aurist, the specialist of any kind first becomes a general medical man before he turns his attention to any specialty; so in my opinion would the dental surgeon be improved if he were to study general medicine and from that arise to the position of dental surgery. The gentleman who preceded me made a very curious statement, that there was no law to prevent any medical man from practicing dental surgery. I cannot place my finger on the law, but unless I am very much mistaken there are several States that declare they shall not do it, and in almost every law that has been framed this provision has been made: "This shall not extend to prevent physicians from extracting teeth." The more medical knowledge we have, the better we are qualified for performing operations and for alleviating the pains of our patients. Are not the same rudimental principles taught in the dental schools that are taught in the medical schools,—anatomy, physiology, hygiene, pathology, and all branches, with the exception of general materia medica and general surgery? Suppose in addition to the branches taught in the dental schools, general materia medica and general surgery are added, would not we be able to pass as M.D.'s? A man would be no more a dental surgeon because he was an excellent astronomer, because he was educated in any of the great sciences, but would it detract from his ability to perform operations well? I cannot understand how any man should object to receiving a thorough medical education in order to become a D.D.S.

Dr. Carpenter, of Atlanta, Ga.: Dr. Friedrichs made the statement that there is no law to prevent a physician from practicing dentistry. There are but few States in which there is not a special statute prohibiting a practitioner of medicine from practicing dentistry, provided he has no other dental qualifications. If he does so he is liable for misdemeanor. It has been stated here that we must first acquire the M.D. before we can learn dentistry. Will any gentleman upon this floor tell me what is taught in the medical colleges, what is printed in the medical books, relating to the specialty of dentistry? Simply nothing at all. They teach you

the general principles of anatomy, physiology, and all those things, but they cannot tell you or do not attempt to teach what the chewing of a piece of bread in the mouth with rotten teeth has to do with the general pathology of the system. I contend that any man who will go to the dental college and go through the courses under the present high standard will be better qualified to become a D.D.S. than he can possibly become in the medical college under its present teachings.

DR. CATCHING, of Atlanta, Ga.: I think my friends are surprised now that I am in the ring, but I am here. I have been shot at by Professor this and Professor that and Professor here and Professor yonder. I have received it from professors all over and all around. I did get one professor up on my side. When I cease to fight this question as I have started out, and as I have done for two years, I shall be a professor in a dental college, and I shall be just like the other professors, but that will be at a late day. It is a hard matter for me to answer the questions of all the professors who have spoken. In fact, I have a very hard audience to speak to, because it is composed almost entirely of professors. We have the aggregate professorship of the United States almost in this hall to-night. I notice that several of the professors say that medical education is a good thing, but you had better take it at the other end. I do not care which end you take it at so that you take the education.

As to the serious results following an operation performed by a D.D.S., there is no question that if a D.D.S. administers chloroform and the patient dies, there is trouble in the camp. He then stands back and looks aghast at his patient. What is the result? The coroner is brought forth. Who makes the certificate? The physician can step forth for his patient and say, "Died of heart-failure." But what can the dentist say? He must simply stand by and let the physician come up and give the certificate of death before the patient can be interred, and if he gives one adverse to the doctor of dental surgery the iron bars will receive the latter.

Prof. Morgan and I have met a good many times on this same battle-field. I hope I shall live as long to fight this question, if it is not gained, as he has lived to work in the dental profession. Prof. Morgan comes down on tip-toe on me. The remark that created the most merriment from Prof. Morgan was something about a physician giving a dose of calomel to act on the liver and yet not knowing how it acted. Now, the very latest researches as to the action of calomel show that it does not act on the liver at all.

DR. W. H. MORGAN: All the worse for the M.D. if that is what he has been teaching.

DR. CATCHING: Prof. Brophy shoots all about. He twists around like a worm in hot dust, and winds up by saying that medical education is a good thing, and the dentist he believes ought to have it.

Prof. Smith comes forward. He represents the dental college of Louisville. One of the most honorable men in connection with Prof. Smith's college, of the medical department, declared to his class some time ago that dentists should be doctors of medicine, and would have to be before they could be well qualified to practice dentistry as a specialty of medicine. That comes from his own school.

Editor Sudduth speaks about secession of the specialists from the general profession. We once tried secession, and it is not very popular in this country.

There is no question as to the value of a medical education for the dentist, and the reason I know it so well is because I know so little of medicine. There is my good friend Dr. Morgan, who is an M.D. Don't you practice medicine?

DR. W. H. MORGAN: I practice medicine in connection with dentistry.

DR. CATCHING: The true specialist is a man who graduates in general medicine and practices that for a while, and then selects which branch he is best qualified to follow, and then pursues that as a life course. Here is an example right here. There is not a better practitioner in the State of Texas than Dr. Storey. Some of the best friends I have are in the dental colleges. I love them like brothers. It is the love I have for my profession that makes me desire to see ours as highly educated as any other profession, and to have dental graduates recognized as being fully qualified to consult with those holding the degree of M.D.

SECTION III.

OPERATIVE DENTISTRY.

Chairmen of Joint Committee, C. EDMUND KELLS, JR., of the Southern Dental Association, and E. T. DARBY, of the American Dental Association.

REPORT READ BY E. T. DARBY, OF THE AMERICAN DENTAL ASSOCIATION.

THE Committee on Operative Dentistry begs leave to submit the following as its report.

We have three papers to present to the Association: the first by Dr. W. Storer How, on "Dental Inlaying with Porcelain;" the second by Dr. J. J. R. Patrick, on "The Rationale of the Construction of Artificial Crowns for the Roots of Natural Teeth;" the third by Dr. C. E. Kells, Jr., of New Orleans, on "Filling-Materials as Conductors of Heat and Cold."

Beside these papers which have been presented, there are other subjects which are worthy of the Association's consideration.

The burden of the profession's thought and the subjects which have received the most attention at the hands of essayists during the past year have been the immediate filling of root-canals, the general treatment of pulpless teeth, the transplantation and implantation of teeth, and the use of copper amalgams.

It is undoubtedly true that the recent introduction in the profession of certain germicides has so greatly lessened the danger of septic conditions that the profession is emboldened to undertake risks with pulpless teeth that would formerly have startled the most venturesome, and yet the reports which have come from some writers during the past year have been so amazing that it would seem wise for us to inquire more carefully into the experiences of the profession at large, and by so doing get the sense of the Association. The implantation of teeth is another subject which has

received much attention during the past year, and the apparent success which has attended the operation makes it one eminently worthy of our consideration. Three gentlemen who have given this subject their attention during the past year or two have given your Chairman the results of their experience.

Dr. E. C. Kirk, of Philadelphia, reports over 30 implantations, with but 2 failures; Dr. S. G. Perry, of New York, reports 27 cases with but 1 failure; and Dr. G. L. Curtis, of Syracuse, N. Y., reports 32 cases and but 1 failure. Other members of the profession have reported a smaller number of cases without a single failure.

It may be asked, What constitutes success in operations of this character? How long a time must elapse before a given case may be pronounced a success, and to what is success or failure attributable? That teeth implanted in artificial sockets do present every appearance of health and subserve every purpose in like manner as teeth which have been developed after the natural process, there can be no doubt. The observation of many and the personal experience of some in the profession who have had such implantations in their own mouths would seem to warrant the assertion that they were to all intents and purposes as good for the time being as their immediate neighbors. It is true that time, and time alone, will answer the problem which confronts the profession when inquiry is made as to the advisability of the implantation of teeth.

The microscope is helping us to determine the factors which are promoting success as well as failure. The experience and truthful testimony of many cannot but aid the profession in forming an opinion as to the value of the operation.

The last subject to which allusion was made as being worthy of consideration is copper amalgam. It cannot be denied that plastics in some form enter quite largely into the process of saving teeth, and that amalgams are generally regarded as necessary in the preservation of certain teeth. It is also well known by many that the English and European dentists have for years employed an amalgam composed of copper and mercury, and that their experience with this material has been such as to warrant them in preferring it to all other kinds of amalgam or alloy. During the last few years American dentists have been experimenting with it, and if we mistake not those who have given it most attention are also of the opinion that it ranks high as a material for saving teeth. The high indorsement of many in the profession would seem to warrant us in saying that copper amalgam has made its way into American

practice and bids fair to retain its position as one of the best filling-materials.

Dr. Gilmer has a new crown which he will describe, and Dr. Custer has an ingenious atomizer to be used in operations upon the teeth, which he will present.

SECTION III.—Continued.

Dental Inlaying with Porcelain.

PAPER BY W. STORER HOW, OF THE AMERICAN DENTAL ASSOCIATION.

IN continuation of the subject of dental repair by the employment of porcelain inlays as described in the *Dental Cosmos* for July, 1888, it is to be said that there are further details of manipulation in the setting of the circular inlays, which will here be briefly presented.

For preparing the cavity in the tooth the barrel burs were adopted as being the best instruments at that time obtainable by dentists for whom the operation was described and shown. Since then the writer has had made by the manufacturing company with which he is connected, a set of nine inlay burs which have straight, slightly tapering sides, and are fine cut on their ends and sides.

The primary preparation of the cavity may be done with any form of bur at hand for the purpose,—as, for example, a square-end fissure bur,—and the depth of the cavity be cautiously, yet judiciously determined to be as great as will be compatible with the continued life of the pulp.

The formation of such cavities in natural teeth which have been extracted, and the subsequent grinding of these into sections through the artificial cavity and the pulp-cavity, will afford an experience that will be useful in aiding one to judge how deep the cavities may safely be made in living teeth of like character.

When the primary cavity has been formed and is about to be enlarged by an inlay bur, great care must be taken to hold the engine hand-piece steady to enter the cavity at the proper angle, and to hold the bur so firmly that it cannot run away and mar the cavity margins. Then slowly yet constantly push the inlay bur down to the bottom of the cavity, being very careful not to chip off

the edges of the cavity by either too great pushing force or by swerving to one side or the other. It is also necessary that the bur should run quite true in the hand-piece in order that a hole of true and equal taper and also a truly cylindrical hole may be formed.

Failure in any of these points will be made manifest in the finishing process, as this discloses the slightest superficial defects.

The inlay must likewise be ground to a true frustum, and this is a work of more difficulty than might at first be supposed, especially when it is considered that the taper of the inlay is to be made correspondent to the taper of the cavity. With this object in view I have made the grinder-rest here exhibited, consisting of a corundum slab-holder and hand-piece support, which, by set-screw adjustment, enables the operator to rest the nose of the hand-piece on the support at an inclination that will permit the rotating inlay to be held on the slab at such an angle as will impart the desired taper to the walls of the inlay. By this means an inlay can be made of a slightly increased taper in comparison with the inlay bur, and therefore the inlay will touch the cavity all around its superficial border, thus reducing the joining to its lowest degree. The tapers of the cavity and the inlay should, however, coincide as closely as possible, because it will often be necessary to cut down on one side or the other, and that will disclose any increasing separation of the inlay from the cavity.

In still further improvement of the accessories to this operation, brass mandrels have been made, and because they are impervious to the water used in grinding, the shellac will stick the inlays to the mandrels with greater firmness than to the wood points. Two of the mandrels are reversible, and a set of three mandrels serves for the set of four inlays. These have been given such sizes and shapes as were deemed suitable for the meeting of nearly all cases, but if there be an occasion for the conversion of a larger into a smaller size, this may best be done at the laboratory lathe by simultaneously running the engine and holding the revolving inlay again at the rotating lathe-wheel. As another means for rapid grinding, a corundum slab having a suitably tapered perforation may be employed; or the arbor-hole of a corundum wheel may be utilized; but neither of these modes seems on the whole preferable to that previously described. The two most difficult points in the manipulative process are the formation of a truly round and nearly cylindrical cavity, and the grinding of an exactly corresponding inlay. Another difficulty is the preparation of a permanent cement of a color similar to that of

the tooth and inlay. Concerning the permanency of zinc oxyphosphate cements, there is nothing new to be said, and with regard to the permanency of inlays set with this class of cements, there are no recorded data on which to base an estimate of the probabilities of inlay continuance in a given case. The most that can now be said is that some zinc oxyphosphates are enduring in the side cavities in some mouths, and that in nearly every instance its wastage, apart from abrasive or attritional wear, is in lines of concavity, leaving the marginal contact undisturbed. A reasonable inference, therefore, is that the thinner the margin the slower the wastage. Hence it is fair to expect that a very close approximation of the inlay margin to the cavity margin will insure a prolonged duration for the thin intervening septum of connective oxyphosphate. The recent publication of inlay articles has attracted the attention of practitioners who allege the setting of them in zinc plastic cements many years ago, and they can doubtless testify to the more or less staying qualities of the work. On the other hand, it may be confidently anticipated that a class of practitioners will declare that the zinc phosphates are ephemeral in all places in the teeth of all mouths, and that inlay work of that character will be disappointing. That, in fact, it should in no case be advocated, and needs no experimentation to verify its clearly inferential impermanence.

Nevertheless, the experienced dentist will recall cases which (as, for instance, the young lady who had an engagement with some other person than the dentist) he would have been glad to have repaired with an inconspicuous material even though it should certainly be renewed within the year.

It will, however, be conceded that, when the long-expected permanent plastic cement shall have arrived, this inlay process will be deemed an excellent mode of repair, as the samples of inlaid extracted teeth herewith submitted for inspection convincingly attest. No. 1 shows a left superior central having a large labial cavity, and No. 2 a like right central that had a similar cavity, which now has an inlay set in zinc phosphate. This inlay was made from an old cavity-stopper, and is not so dense as the inlays now furnished, nor is its shade closely similar to that of the tooth; but the operation is obviously, in some respects, an advance upon anything hitherto brought before the profession, and so far as appearances go it would be difficult to excel the similarly inlaid lower right and left cuspids, Nos. 3 and 4, the latter being readily accepted, as it indeed has been, for a perfectly sound tooth.

The vertical section of a central shows the close fitting of the inlay walls with the cavity walls, even after the surface has been cut down considerably around the margins. It also shows the absence of any cement on the floor of the cavity, and that fact in part explains the close contact of the wall; a very essential element of success in the operation.

The color of the cement modifies the appearance of the inlay, which is more or less translucent, according as its shade is light or dark, and the color of the cement should therefore harmonize with that of the inlay when that is like that of the tooth; but when, as must frequently occur, the tooth is not exactly matched by the inlay, this may be toned up or down by a suitably colored cement such as experience only will enable the dental artist to prepare.

A practically permanent inlay can be made with gutta-percha as a joining medium, and the sample No. 6 shows that a very close wall-joint may be made, and the floor also covered, because the mode of manipulating the gutta-percha admits of the complete filling of the cavity.

In practice, the fitted inlay, some preparation of gutta-percha, as Hill's stopping, and the required instruments, are all made hot on a dry water heater, the cavity dried with warm air, the cavity walls thinly lined with the gutta-percha made soft enough to stick to the walls, the inlay put in with a pair of pliers, and quickly pressed home with the hot flat end of an instrument large enough to retain and impart to the warm inlay heat sufficient to completely soften the gutta-percha and cause all the surplus to exude around the inlay. A cold instrument is then immediately substituted for the hot one, and pressure continued until the normal temperature has resulted.

After a short interval to allow the thorough cooling of the gutta-percha, the surface of the inlay may be ground and polished, and the operation finished at that sitting. No. 7 is an example of a small inlay which has been darkened by a bluish shade of gutta-percha, but the joining is a mere line, and the operation is such as would prove permanent and not unsightly in the mouth.

Too great care cannot be taken not to overheat the gutta-percha, and so darken it; nor to soil it or the inlay or the cavity margins; nor to fail to completely surround the inlay with gutta-percha. Either of these errors will be discovered as a blemish when the polishing process shall be commenced.

No. 8, an upper left lateral in section, shows a close-fitting, yet imperfectly surrounded inlay set in gutta-percha. No. 9 likewise

shows one imperfectly set in crude white gutta-percha. No. 10 is an upper right central, having a small inlay set in sandarac, but it, as well as copal and mastic, has a yellow tinge, which is deepened by the melting heat necessary to soften it sufficiently, and hence a darkening of the inlay results.

At the present writing, gutta-percha softened by heat appears to be the best obtainable joining material, all things being duly considered.

The uses of these inlays will not be confined to the circular-form cavities previously described, but in many buccal and crown cavities which cannot be given a circular form, the inlay may be approximately conformed, and set in gutta-percha with very satisfactory results.

In large crown and compound cavities where the pulp is nearly exposed the inlays may be set in cement with their bases inward, and so serve as caps to the pulps. In these instances the cement should extend but half-way up the inlay sides, and the remainder of the cavity be filled with gold or amalgam.

Many cases will arise in which, by notching or otherwise grinding an inlay, it may occupy the bulk of a cavity and present a porcelain surface for mastication, thus in a great degree diminishing the otherwise unsightly aspect of a large metal filling.

SECTION III.—Continued.

The Rationale of the Construction of Artificial Crowns for the Roots of Natural Teeth.

PAPER BY J. J. R. PATRICK, OF THE AMERICAN DENTAL ASSOCIATION.

IT is generally conceded by well-informed members of our profession that all roots of natural teeth that are in a healthy condition are available as substructures for artificial crowns; but the construction of artificial crowns and their adjustment to the natural roots of teeth are not, in my opinion, sufficiently understood. I will therefore ask your attention while I present a few principles that are involved, which, if not recognized, must result in defective work.

In order to secure the best results in attaching an artificial crown to the root of a tooth, a gold band encircling the root of the tooth, and passing between it and the gum, is the first step in the process, after the root is prepared. Success will depend on the nice adjustment and close fit of this band to the tooth-root; for I maintain that a band of gold fitted to the root of the tooth to be crowned is indispensable, and the first requirement in constructing an artificial crown.

The difficulty in fitting a band to the root of a tooth consists in the fact that it makes no difference what tooth-root you are preparing for a band, you are dealing with the base of a cone, and the farther you go down from the base with the band the poorer the fit. The reason I mention this is because I have seen so many crowns put on by very good practitioners which had to be removed, and when removed exposed the defect I have mentioned. The portion of the tooth which you have to deal with is the thicker end, and you have to drive your band over it; and the farther you go down, as I have said, no matter how beautifully the work is finished, the

poorer and weaker it will be, for the reason that the band will stand out from the tooth more or less, in proportion to the distance it is driven on, leaving a space between the root and the band, excepting at the actual line of contact (Figs. 1 and 1*a*).

All roots of teeth have canals, or a canal. The canal follows the external form of the root. There has been much importance at-

FIG. 1.

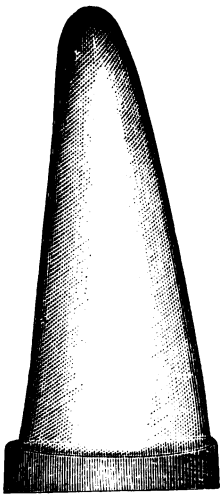

FIG. 1 *a*.

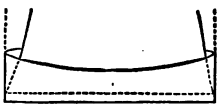

FIG. 2.

FIG. 1.—Band driven onto a root squarely.

FIG. 1a.—Diagram of the same.

FIG. 2.—Vertical section through root, crown, and post. Dotted lines show direction of post and also the uneven space excavated in the root for the lodgment of cement or amalgam to give anchorage to the crown and post.

tached to posts as a means of stability for the attachment of crowns, but unless a post taper in conformity with the canal of the root, it is an element of weakness. If you use a post that is not tapering the canal must be enlarged to suit the post, and whether the post is threaded or plain the result will be the same,

weakening the point of attachment, and the farther such posts enter the root-canals the weaker the attachment becomes (Fig. 2).

If a smooth tapering post be used, either square or round in form, previously fastened to the crown, either soldered or baked in the crown, the fixed point of the post becomes an element of weakness; for the crown and post become a lever to drag the tapering end of the post from the canal. Now, a tooth-crown with a post permanently attached could not be used in connection with a gold or platinum band to embrace accurately the periphery of the root, for of necessity it would have to go on straight, and, doing so, the band in its relation to the root would be in the condition shown in Fig. 1.

If, however, a post can be used to advantage (which is seldom the case), two fixed points would be preferable, but, unfortunately, impracticable; one, however, can be obtained, and that one is in the end of the post that enters the root. The post, when one *is* used, should be a conical screw, the screw end a little larger than the natural root-canal, the blunt end split and slightly spread apart so as to take hold of the cement in the artificial crown. A porcelain tooth with a pin, or post, baked in the body, can never be ground to fit the surface of the root presented. Of necessity the root-canal must be enlarged in order to procure space and as little surface-contact as possible, the intervening space filled in with plastic material,—*the natural substructure weakened to accommodate the superstructure* (Fig. 2).

All the roots of teeth in the human mouth cannot be utilized for post anchorage. Such as may be used under ordinary circumstances with safety may be enumerated as follows:

The superior incisors, cuspids, palatal roots of the first and second molars, and, if great care be exercised and delicate posts used, the palatal canals of each of the bicuspids. Thus we have fourteen root-canals out of twenty-six enumerated, that may be utilized for post anchorage, if a canal post be used. Now, it will be observed that there are the same number of root-canals in the corresponding teeth of the lower jaw; but the bicuspids of the lower jaw have but one canal in each tooth-root, the upper ones, two; and the incisors of the lower jaw have two canals each, whereas the upper incisors have but one each.

Where a root-canal is small, as in the lower incisors, a conical post without a screw point would be useless, as the canals do not admit of enlargement sufficient to receive the quantity of cement necessary to secure it in place; whereas, a conical screw point does

not require the assistance of cement to keep it in place, and it is constructed and selected with reference to the size of the canal in each root of each tooth, so that the twenty-six root-canals of the teeth of each maxilla can be provided, when necessary, with a conical screw post, without enlarging the natural canal, which cannot be done with any other form of post.

The use of a post in a natural root to give stability to an artificial crown is by no means necessary in the greatest number of cases, and while its use is sometimes indispensable to success, nevertheless I consider the band that surrounds the root a more important factor of stability, when properly adjusted. When we reflect that there is not a root of a tooth in the human mouth but presents the base of a cone to the operator, and that this base has an under-cut around it, it becomes an easy matter to bevel one-half of the base, leaving the other half under-cut; then bend a ribbon of gold in the form of a hoop, approximating the size of the root, with its ends bent at right angles from its circumference, and slip it down between the gum and the root, a little below the beveled portion; then, with a pair of parallel pliers, seize the free bent ends of the hoop and pinch them together, remove the hoop, or band, cut, slightly lap, and solder. The band thus made, after the joint is made smooth, is again put on the root by first pushing one portion of its edge under the under-cut and forcing it over the beveled side with a foot plugging instrument, assisted by a few sharp taps of the hammer. If the band is the right size, it will tuck in under the bevel, if not forced down too far. *The band must just pass the lower edge of the bevel and no more.*

The band being in place, the next step will be to adjust the grinding-surface of the crown to the occluding tooth. If there is plenty of room, the crown may be telescoped over, or inside of, the band, but usually it is placed in simple contact or flush on the band. The operation of adjusting the occlusion is accomplished by putting the crown in place on the band, when, the jaws of the patient being brought together, the opposing tooth will indicate on the metal crown the depressions or projections necessary to be made. The alterations on the engaging face of the crown are produced by the use of adapting pliers (Fig. 3) made expressly to give the proper surface projections and indentations. The occlusion perfected, the crown is then removed from the mouth of the patient and the cusps filled solid with solder. The band is then lifted from the beveled side of the root, soldered to the crown, and finished.

It will be observed that the counterpart of the opposing tooth can be obtained upon the artificial metallic crown, without reducing the thickness of the metal by subsequent grinding. The time and endurance of the patient are saved, and a needless waste of material avoided.

In setting the crown on the root permanently, it will be observed that when the band was forced upon the root it was adapted to the root contour by stretching, and when removed to be soldered to the crown it was again slightly stretched. This can be shown by the ease with which it can be put on and taken off a second time. So in order to have the band fit the root as tightly and as perfectly as it did in the first instance, it must be reduced slightly in size by

FIG. 3.

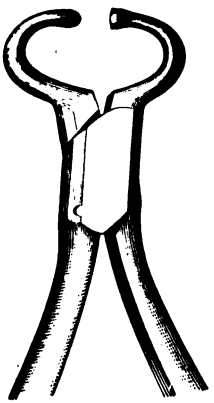

FIG. 3.—Reversible adapting pliers for the occluding surface.

shrinking, and this is done by the use of a shrinking die. The crown now being ready for adjustment, is filled with cement in sufficient quantity and carried to the root, the band portion of the crown pressed close under the under-cut, and then pressed to and over the beveled side of the root, stretching it as before, when the excess of cement will be forced out, and at the same time carry with it all air-bubbles that otherwise would remain if the crown were put on squarely.

It may be asked how a crown provided with a band could be put in place, if the root had been previously provided with a conical screw post. To which I will reply: If it is a gold crown, a post can be used that will extend above the root one-third the depth of the hollow crown, which will be found sufficient, for nothing would

be gained in anchorage by extending it farther. In such cases the crown would be brought squarely down on the post, then tilted over to the under-cut side of the root, and again pressed over to the beveled side, and pressed home. As a rule, the most pronounced under-cuts of the posterior teeth are found on their anterior and posterior surfaces, and on the cuspids and incisors at that bulbous

FIG. 4.

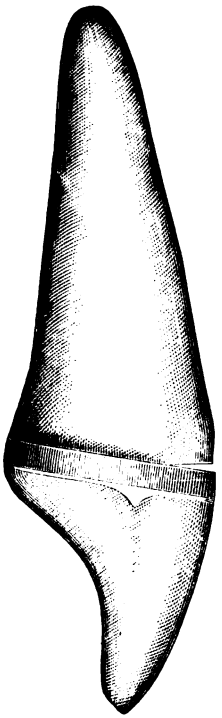

FIG. 4a.

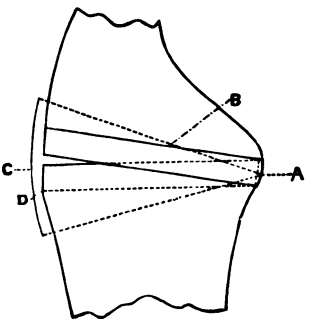

FIG. 5.

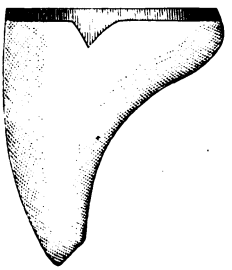

FIG. 5a.

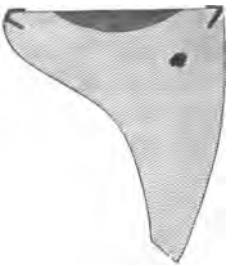

FIG. 4.—Perspective view of crown in position ready to be carried over the bevel.

FIG. 4a.—Diagram of same—A, vertex; B, radius; C, arc; D, point of contact of the band with the bevel on the tooth-root.

FIG. 5.—Perspective view of porcelain crown.

FIG. 5a.—Vertical section through the same, showing the position of pins and platinum band.

portion at the site of the termination of the enamel on the posterior or palatal surfaces, and these are the points to take advantage of.

In putting crowns on the superior anterior teeth, the bands should be pressed below the bulbs and carried forward to the front, or labial sides. When so inserted, the pressure on these teeth in mastication can never disturb them (Fig. 4). It will be observed that when a band is pressed close to the under-cut and held firmly in

place, making it a center for the movement of the band, the point becomes the vertex of a radius which the band represents; and when brought down over the termination of the bevel, describes an arc, the angle of which in most cases would be about thirteen degrees. Now if the lower portion of the band is made to impinge the bevel side a little above its termination so that a degree of force will be necessary to carry it over, the band will stretch, and in stretching its lateral portions will be constricted and adapted to the lateral under-cut margins of the root. From the fact that the band is made to describe an arc when being adjusted, it is clear that as it passes over the bevel it draws nearer to the tapering root, whereby a closer fit is secured than can be made in any other manner (Fig. 4*a*).

The posterior and anterior contours of the cervical portions of the inferior incisors are about equal, the lingual side of the cuspids similar to the upper, but the pressure on these teeth being inward, they receive additional strength from lateral pressure. A little practice with bands on the natural roots of teeth out of the mouth, observing the points I have indicated, will convince anyone of the correctness of these statements.

I have stated that it was seldom necessary to use a post of any kind when a band encircles the root properly, and it is with this view that I have constructed a porcelain tooth-crown with a platinum base, or band, encircling the cervical margin, baked into the body of the tooth. The tooth is without pins in the ordinary sense, and admits of the surfaces and margins being made in the true form of a natural one (Figs. 5 and 5*a*).

The advantages these teeth possess over others may be stated briefly. 1st. They can be attached to the band that encircles the tooth in one soldering. 2d. Moisture is effectually excluded from the cement. 3d. They can be ground down without fear of exposing pins. 4th. They are stronger, from the fact that the point of attachment encircles the whole tooth at its cervical border, or margin. 5th. They can be soldered together at their lateral margins, a quality which renders them useful for bridge-work. 6th. All crowns of teeth in the human mouth where bands can be used can be reconstructed by their employment, including the inferior incisors, which is almost impossible with any other form of porcelain tooth. 7th. They can be soldered to the band at any inclination, as the base of the tooth resting inside or on the band can be rotated like a ball in a socket.

Porcelain crowns for the posterior teeth are made in the same

manner. A molar tooth can be placed on the band at the inclination desired to occlude with the opposing tooth, the metal base marked with a sharp instrument, the band and crown removed, the crown imbedded and the band adjusted and soldered to the base of the crown at the inside of the band, and then the crown is ready for insertion.

There are many teeth which can be treated successfully with gold crowns or caps, in which the band, which is indispensable in the process of reconstructing a crown on the root of a tooth, is dispensed with. I refer to the molar teeth of young persons, in which the enamel of the grinding-surface is defective,—granular, full of pits, and pin-point spots of decay. Usually such teeth are superficially decayed at the anterior and posterior surfaces, but not far enough advanced to expose the pulp in removing the defective parts. If the posterior and anterior surfaces are trimmed at right angles with the grinding-surface and the prominent portions of the surface removed, a gold cap or crown can be made to cover the defective parts, and if properly made and adjusted will be superior to any gold filling, however well performed. In the accomplishment of such work less preparation of the tooth is necessary, more of the tooth-substance is saved, and, consequently, the patient is relieved from a long and tedious nervous strain in the operation, for the crown or cap is made in the laboratory in a few minutes, and, when the process is understood, it takes but a few minutes more to adjust it in the patient's mouth. [Here a natural tooth was shown, the crown covered, as described, with a gold cap.]

I am very well aware that gold crowns can be made and attached to the roots of teeth, after a fashion, and to answer a purpose. I am also aware that porcelain crowns are manufactured and used, with a total disregard of the living parts to which they are designed to be attached. Very clever and ingenious men, with commendable industry, do produce gold crowns, made up of solder, shreds, and patches, whose estimate of the value of their own productions is based on the amount of labor expended on the work with the fewest number of tools, rather than on symmetry of construction with the smallest expenditure of labor and the least amount of solder.

A gold crown should be made of one piece of metal, and when formed should be of uniform thickness throughout. This cannot be accomplished by driving a flat piece of metal from which the crown is to be made, into lead with a hard die, or driving the metal into a

hard die with lead. In either case the metal plate becomes of unequal thickness, the margin of the grinding-surface becomes thin, and the sides are thrown into unequal folds; these folds when beaten down cause the sides to become thick in places. If the folds are cut out and the opposing parts brought together and soldered, the pliability of the metal is destroyed. I have stated that a crown made up of metal, to be of value, should go on to the root, or, if a cap, on to the crown of a tooth, with a stretch, in order to adapt it to unequal surfaces. It will therefore be conceded that uniformity of thickness in the metal and the smallest quantity of solder compatible with strength are important factors in the accomplishment of the desired end.

The choice of material from which a crown or band is constructed is of equal importance with the manner of adjustment, for, if the metal is refractory or too pliable, our success will fall short of our expectations; stability and adaptability combined are the properties required in the metals used for bands and crowns, and these properties are obtained in the following formulæ:

CROWN GOLD.

Pure gold	15 parts
Platinum	1 part

Cyanide potassium, 5 parts fused in a coke fire for 30 minutes at least

BAND GOLD.

Pure gold	1 part
Gold coin	1 part fused

NO. 1 SOLDER.

Band gold	89 parts
Pure silver	7 parts
Pure copper	4 parts
Borax	10 parts fused

NO. 2 SOLDER.

Solder No. 1	89 parts
Pure silver	7 parts
Pure copper	4 parts
Borax	10 parts fused

The formulæ of alloys here given for gold solder will be found to contain all the following properties in a high degree:

1. Two surfaces of gold are caused to unite with solder, partly by cohesive force and partly by chemical attraction, and it follows that the solder used should not only be more fusible, but should have a strong affinity for the gold without impairing its natural qualities.

For this reason, *all gold solder should be made from the gold that it is to be used with.*

2. When gold solder is used to unite two surfaces of gold that are expected to stand much strain, it is a matter of first importance that the solder should be as near the quality of the gold as possible. No baser metal than copper should enter into its composition.

3. The solder should be as malleable and as ductile as the gold that is soldered, and, when polished, be the same color as the gold.

These separate combinations of metals are rolled into plate the thickness of No. 29 or 30, American standard gauge, and, after annealing, are ready for use.

In constructing a gold crown, the crown gold plate is put between a cutting punch and die, the punch and die being secured in a press,

FIG. 6.

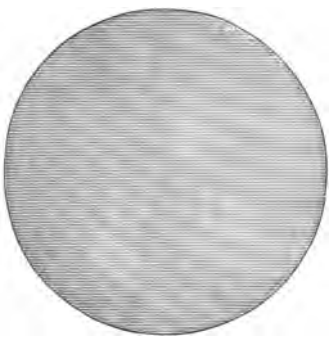

FIG. 7.

FIG. 6.—Blank for gold crown.
FIG. 7.—Blank formed into a seamless cup.

and a circular blank is cut at one stroke from the gold plate (Fig. 6). The cutter and die are removed from the press and a plunger and cupping-die inserted; the blank is now placed in the countersink of the cupping-die, which gives it the true center. This done, the plunger is brought down and the blank is forced through the die, which forms the cup (Fig. 7). The plunger and die being removed, a hammer is placed in the press in the same manner as the cutter and plunger. The tooth die in relievo is selected with its corresponding intaglio die. The die in relievo is pressed into the annealed cup, the cup and die placed in the intaglio die, and both are put under the hammer and pressed together. This completes the process. The crown is made without a seam or fold, and of uniform thickness throughout (Fig. 8).

It will be observed that the cusps and depressions in the crown

made by this plan are produced by changing the surface of the metal without making it thinner, as the dies fit each other to begin with, less the thickness of the metal used. The depressions on the surface of the crown are produced by reversing the contour of the bottom of the cup, and that portion of the cup which is not depressed forms the cusps with very little pressure. This change in the surface of the metal could not be made upon a flat surface without reducing its thickness at the indentations. What we need in a metal crown is the general outline of a natural tooth, not a perfectly cusped tooth; for experience teaches that where metal crowns are used, the occluding teeth are worn, and the artificial crown must correspond to be of service; consequently, the cusps of the metal crown

FIG. 8.

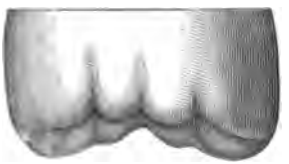

FIG. 9.

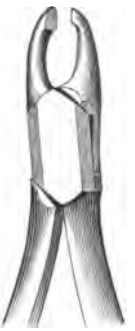

FIG. 8.—Anterior view of a gold crown formed from the cup (Fig. 7).
FIG. 9.—Reversible contouring pliers.

must be depressed, and hence the necessity of the adapting pliers (Fig. 3).

The sides of a metal crown require to be modified to meet the requirements of each case. To meet this necessity the reversible contouring pliers are provided (Fig. 9). These pliers are indispensable in adapting a band to the root of a tooth where the under-cut is taken advantage of. Especially are they useful in forming the bands to fit the lingual, puffy margin of the six anterior superior teeth.

That the roots of natural teeth, when in a healthy condition, are valuable as substructures for artificial crowns is no longer a question, but the extent to which reconstruction may be resorted to is a question yet to be determined.

I have two cases in point that I desire to present for your consideration. A gentleman consulted me in regard to a right superior

first bicuspid that a short time previous had been broken in an attempt to extract it. The fracture occurred a little below the thin edge of the process. As the prospect of giving him relief from his

FIG. 10.

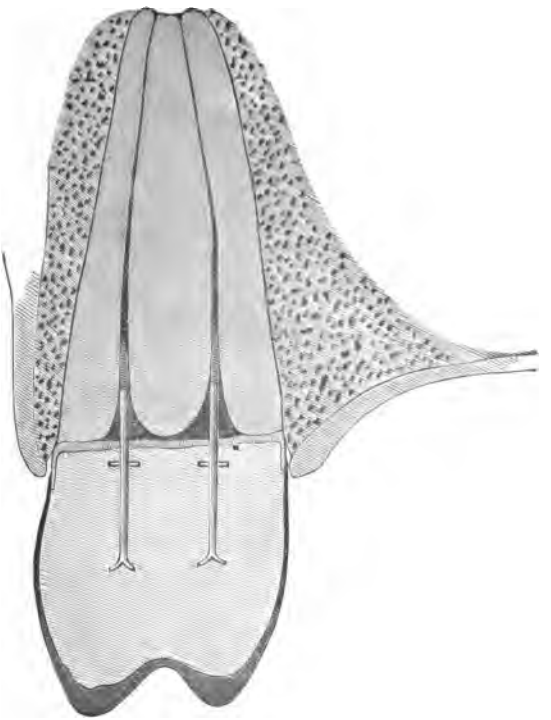

FIG. 10.—Vertical transverse section through root, reconstructed part, posts, and gold crown.

FIG. 10*a*.

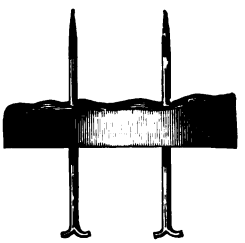

FIG. 10*b*.

FIG. 10*a*.—Perspective view of reconstructed part and conical screws.
FIG. 10*b*.—Perspective view of the gold crown.

suffering by attempting the extraction of what remained of the root was exceedingly doubtful, I concluded to destroy what remained of the pulp; to this end I prepared a short canula by turning up into a scroll a piece of thin platinum, the ends overlapping. This I slipped

FIGS. 11 AND 12.

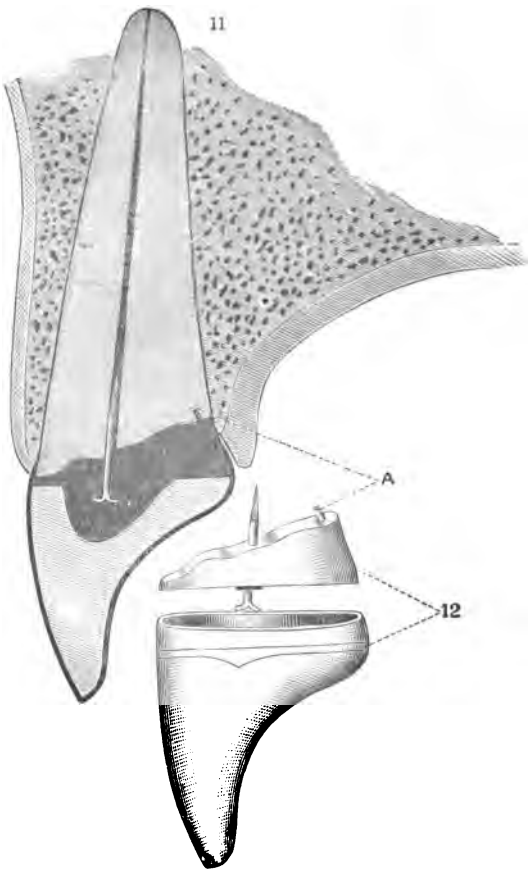

FIG. 11.—Vertical section of left central incisor from the posterior to the anterior, showing reconstructed parts in place.

FIG. 12.—Profile view of reconstructed portions in sections. A, the dowel or pin.

into the orifice. After cleansing and drying, I could see the condition of the fracture and what remained of the pulp; applied the usual drug for its destruction and filled the canula with wax, by which means the soft parts were distended and prevented from closing. The day following, removed the canula and the dead pulp,

cleansed the parts, adapted the canula to the periphery of the fractured root, and obtained an impression of the fracture with impression compound packed into the canula. Made a cast from the impression in hard plaster, and burnished thin platinum foil on its surface, annealing several times. The platinum canula was adjusted in size to the periphery and inequalities of the fracture, and soldered in place to the thin platinum foil, which now formed the base of a cup. The walls of the cup were then strengthened by introducing a scroll of thin platinum, and the base of the cup was made strong with solder. (*The solder I use for platinum is always pure gold.*) Two holes were next drilled through the base of the cup in correspondence with the root-canals, conical screws introduced and marked at the base of the cup and then removed. Small washers were then slipped on to the screws to the point marked, and soldered. After finishing the outside of the cup a light film of liquid gutta-percha was spread over its base, the surface of the fracture dried, the cup put in place, and the screws introduced and screwed tight to the fractured root. The cup was then filled with cement and the gold crown telescoped over it (Figs. 10, 10*a*, and 10*b*).

The second case is that of a gentleman who was unfortunate enough to have the left superior central and lateral incisors broken off by a blow.

The fractures in both teeth were from the anterior to the posterior, commencing a little above and running down from the cervical border at the labial side to a little below the cervical border at the expense of the palatal side. The crown of the central incisor was broken into fragments, the crown of the lateral was whole. The process of taking the impressions of the fractured surfaces of these teeth was similar to that in the previous case, but was somewhat more complicated, owing to the obliquity of the fractures.

Fortunately, the crown of the lateral incisor being whole, the surface of the fracture served for the model.

By reference to Fig. 11, which is an anterior to posterior vertical section of the central incisor, and Fig. 12, which is a perspective view of the several parts reconstructed, it will be seen that the work reconstructed under the gum presents an inclined surface to the fracture, and a level surface to the crown; it is, therefore, an acute angle in form and could not be retained with firmness, on the inclined fracture, with a screw alone. Hence the necessity of a pin, or dowel, in the reconstructed part, at the lowest portion of the incline (Figs. 11 and 12, A), soldered into its place at right angles with

its inclination, and penetrating the substance of the tooth not more than the sixteenth of an inch. It is plain that when the washer is brought to bear on the horizontal plate of the reconstructed section by the action of the screw, the dowel is carried into the hole designed to receive it, and the reconstructed section becomes a fixture.

It is in all such cases that the conical screw becomes an absolute necessity.

After reading his paper, Dr. Patrick said,—

There has been of late years a great deal said in regard to implantation. Many theories in regard to it, if proved, must upset all known physiological law in regard to the relation of the tooth implanted to the part surrounding it. I propose to make an artificial tooth, root and all, presenting a smooth but undulating surface like the natural root, and implant it in a healthy person, with the expectation that it will be retained more perfectly than the natural teeth which are now being used for that purpose, and I expect the artificial tooth so implanted will be retained in place by the well-known physiological process of proliferation.

SECTION III.—Continued.

Filling-Materials as Conductors of Heat and Cold.

PAPER BY C. EDMUND KELLS, JR., OF THE SOUTHERN DENTAL ASSOCIATION.

IT is not unusual to hear or read of the oxyphosphates and oxychlorides being non-conductors of heat and cold; and, therefore, pulps exposed, or nearly so, when secluded from the oral fluids by such fillings, are rendered unconscious of the thermal changes to which the teeth are constantly liable.

The result of the use of these materials in my own practice has never led me to believe in their non-conducting properties. However, we are not here to discuss the question in the abstract, but to see some practical demonstrations, which it is believed will convince the most skeptical.

Here is an apparatus consisting principally of an electric battery, bell, and a little instrument called a thermostat, which consists of a zinc disk, slightly concave, held rigidly at its edges in a hard rubber base. Through the back of the base and in its center is fixed a finely-threaded screw, to the head of which is attached a lever to admit of its delicate adjustment. The zinc disk and the adjustable screw may now be placed in the "circuit" with the battery and the bell, and if the screw is turned down until it impinges upon the back of the disk the electric circuit will be completed and the bell will ring. By giving the screw a portion of a turn to the left, its contact with the disk is broken, the "circuit" is broken, and the ringing ceases.

If heat be applied to the disk, it follows the natural laws and expands. However, being rigidly confined at its edges, it cannot expand laterally, and in consequence it must bulge towards the screw. Upon the withdrawal of the heat it contracts to its former position. To illustrate, I will adjust the screw until it does not

quite touch the disk, and then drop upon the disk's center a single drop of warm water, when the result is at once apparent. That such a small quantity of water will produce such an effect shows the delicacy of the instrument. To prove that it is the heat and not the moisture that operates the bell, a drop of cold water will be placed upon the disk, and there is no audible result. This demonstrates that it is sensitive to heat and not to moisture.

Here is a small cell, formed from the crown of a molar by grinding down the cusps and cutting out the dentine until only the enamel is left. This I will place upon the disk and fill with water at a temperature of 140°. There is no sound. Replacing this by a cell of about the same size made of copper amalgam, and repeating the experiment, we see that hardly has the water touched the amalgam when the bell rings, showing the immediate transmission of the heat through the amalgam to the sensitive disk, thus manifesting itself conclusively as a good conductor.

To compare the different filling-materials to each other and to enamel, here are cells, corresponding in size, of gold, tin, copper amalgam, Hardman's alloy, oxyphosphate, oxychloride, red gutta-percha, Dawson's gutta-percha, and none of them will stand the test. These may be divided into classes, the metals coming first as the best conductors, the difference between them being but slight. Next come the cements,—the oxyphosphate being perhaps a shade poorer than the oxychloride; then the gutta-perchas come last, although far from being non-conductors, not even equaling the enamel in that respect. Here are a few cells composed, one of amalgam, with a thin layer of gutta-percha replacing a portion of its thickness; another of amalgam and oxyphosphate, in the same manner. These cells are of the same total thickness (1–16 inch) as those just tested, and you notice how the bell is rung *through them.*

[Dr. Kells then proceeded to show the working of the apparatus as described with the different cells mentioned.]

From what we have seen and heard, especially the latter, we may conclude:

First—That the oxyphosphates and oxychlorides are such comparatively good conductors of heat and cold that they should not be used alone for capping pulps exposed or nearly so.

Second—That such pulps should be protected by a layer of gutta-percha fully 1–32 inch in thickness, when possible.

Third—That no filling-material equals the enamel in its kindly protection from thermal influences of its delicate *protege* within.

SECTION III.—Continued.

A New Tooth-Crown.

REMARKS BY T. L. GILMER, OF THE AMERICAN DENTAL ASSOCIATION.

IT is now fully demonstrated that the various kinds of gold crowns are a grand success, and their advent has placed dentistry in a position which affords us opportunity to do very much more for our patients than heretofore.

To my mind, the best dentistry is that which gives the greatest good to the greatest number of persons. There is a large class of patients who, while fully appreciating the best services, are financially unable to supply themselves with gold or gold and porcelain-faced crowns. Recognizing this fact, I have for some time been casting about for a crown which, while being quite as serviceable, so far as the preservation of roots of teeth and mastication are concerned, could be made at a low cost in material and in time, the latter being the more important consideration. I have succeeded in making such a crown by a combination of a platinum band and Weston's or Watt's metal for the posterior teeth and a gold band, porcelain front, and this fusible metal for anterior teeth. They are made quickly and easily after the following method: After the root is prepared, a band of platinum one-quarter to one-half the length of the desired crown is adapted to it. The band is then removed, and a number of small holes drilled through it, midway between the upper and lower borders, and a slit cut from each of the holes to the upper border (see cut), after which the band is replaced on the root and the septa are bent slightly inward and outward alternately. A model is then made by placing sufficient modelling composition on the root and band, directing the patient to articulate the teeth; and when the modelling composition has hardened, partly shaping it with a knife, the whole being then removed from the mouth and the carving

completed. The model is then invested in plaster as far up as the composition extends on the band, a couple of grooves cut to insure proper replacement of the parts, and the investment with plaster completed. When the plaster has set it is warmed, the modelling composition removed thoroughly, and a countersunk pouring-hole an eighth of an inch in diameter is made through the upper portion of the mold, toward the buccal or palatal portion of the tooth and just within the band. A small vent-hole is also cut just opposite, inside the band. The mold, the two sections of which are secured to each other with binding wire, is then dried out, and Weston's or Watt's metal poured, slight pressure being made with a conical piece of wood inserted in the pouring-hole while the metal is yet fluid to insure its being forced into all the cuts in the platinum band. The upper half of the mold should be at least one inch in thickness to give sufficient head to the melted metal. But to save time in drying the plaster less than one-half this thickness may be used by employing a tapering tube through which to pour the metal. The tube should be four and a half inches in length, three-eighths of an inch in diameter at its largest end and one-fourth of an inch at the other, and it may be made from a part of a brass mouth blow-pipe. This gives a greater head and dispenses with the use of the conical piece of wood. The setting may be done by almost any of the usual methods in such cases. A crown so made answers quite as well for the posterior teeth as though made of gold. For the anterior teeth, or for bicuspids when exposed to view, a gold band can be substituted for the platinum, with a porcelain facing, the modelling composition being used as before to get the lingual face of the tooth. When using a porcelain facing the pins should be bent toward each other, to better secure it. In case a porcelain facing is used, the investment should be made so that the lingual surface of the crown may be uppermost and the metal poured directly on it, and not through the band as in those made entirely from metal. If a pin for the root is desired, insert it so that it shall be removed with the modelling composition and band and the metal cast around it.

DISCUSSION.

DR. GENESE, of Baltimore: I think that in inserting one or two screws in the roots of biscupid teeth, as Dr. Patrick suggests, there would be a possibility of splitting the two roots, particularly if they are not prepared previously for the size of the screw posts that are put in.

DR. FILLEBROWN, of Boston: I want to express my hearty appreciation of these experiments and of the instruction they have given me, and to ask Dr. Kells what is the comparative conductivity of dentine. His experiments show plainly that if we could get disks of enamel to cap over nearly exposed pulps, we should accomplish a great deal. It is possible that the conductivity of dentine is so nearly the same as enamel that it may prove a bonanza for us, for it is quite practicable to get thin disks of dentine with which we might cap over the pulps of teeth, with a little solution of gutta-percha underneath it. With such a combination we should find something that is really valuable as a therapeutic or a preventive agent. Will Dr. Kells please answer us?

DR. KELLS, of New Orleans: I would say that in my experiments so far I have limited myself to these materials which I have shown you to-day. In order to compare the different materials it is necessary to have the same amount of surface exposed to the heat of the warm water, the water of the same temperature, and the same amount of surface of the cells in contact with that of the disk. I took the enamel of a molar, and to that I have conformed the other materials. I have never tried dentine. It would be necessary to get a perfect cell of dentine, and then to make a mold from that. I think I will act upon Dr. Fillebrown's suggestion, and report at a future time.

DR. ATKINSON, of New York: I have to say, *Cui bono?* what good is this? I am the last man to discourage experimentation, but I am the first to say, be careful about your experiments that they be intelligibly executed. That the enamel is a protection to the pulp against shock everybody knows, and as soon as they have worn their teeth down so that there is no longer any enamel on the occluding surfaces, and no secondary dentine deposit intercepting the known conductibility of the dentine, they will get a shock. I have had many old men who could not eat cold pie by reason of the conductivity through the thinned-down wall of dentine. I am delighted with what Dr. Kells has done, and only make this suggestion that he be careful to not spend his time nor the time of those who listen to him when there is really no point to be gained. What do we know of conductivity,—at least only in this unnatural manner of its presentment? Is not the shock of chill really a part of the true function of the body? Does it not keep us in working condition? There are a good many questions which arise in this connection to a physiologist or a histologist that would have to be settled before we

could utilize this experiment. Further than that this does not belong in this body. It belongs somewhere else until it is perfected. We are not all greenhorns, nor all beginners, but God knows there is a good deal we ought to have begun which we have not touched as yet. That is all I care to say upon this question.

DR. PEIRCE, of Philadelphia: In common, I hope, with all of you, I was delighted with the exactness of Dr. Kells's experiments, but with his conclusions I am at issue. We are all aware, and were previous to seeing the experiments, that these materials differ in conductivity, but in considering them in that relation we entirely ignore the physiological and pathological conditions of the teeth, and therefore when he drew conclusions that one or the other was better to cap a pulp by virtue of that conductivity, he certainly drew conclusions not safe for us to recognize. If we were protecting the pulp from thermal changes where it was not exposed, then these experiments would be right to the point, because the pulp having already its normal protection, we could cover it with some material that was a non-conductor and protect it from the influence of thermal changes. But here we have the vascular tissue thoroughly exposed and we wish to protect that tissue in a vital condition. His conclusion was that because gutta-percha had the least conductive power it was one of the best materials, while in a large number of conditions gutta-percha is the very worst material that we can place on an exposed pulp, and the worse because it is nothing but a mechanical covering; it has no influence whatever on that tissue save to cover it mechanically. Suppose on the surface of an exposed pulp any exudation is retained, it must intensify the condition and not in any way tend to the calcification of that organ, but rather retard it or cause its death, while if I make an application to that pulp of some material that has some therapeutic qualities, —that is an escharotic or an antiseptic,—I may overcome that exudation by cauterizing the surface, and in that cauterization secure a non-conducting surface that is indestructible, and then I can coat over that some material and have the pulp safe; or if we have an exudation I may use a powerful antiseptic and so prevent the disintegration and save the pulp. In my experience, while I may save probably twenty-five per cent. of teeth and pulps by covering with gutta-percha, where there is no exudation, I could probably save fifty or seventy-five per cent. with some other material.

DR. KELLS: I shall have to beg indulgence for a few minutes longer. I am very glad the gentleman has raised that point,

because some others might have gone off with the impression that I was advocating gutta-percha as a capping for exposed pulps. If he will bear in mind, I did not say *cap* exposed pulps with gutta-percha, but I did say a layer of gutta-percha should be used. In my own practice, when a pulp is thoroughly exposed,—I will be candid with you,—I usually destroy it, because if I don't do it that day I should have to do it some other day, or it would die of its own accord. If I were to cap a hundred pulps, if I saw them again I should expect to see a hundred failures, provided those pulps were thoroughly exposed. As I have before said, a pulp that is exposed I generally destroy. I know many men can save pulps, and if they can it is their duty to do it, but those who cannot should destroy them at once. If the pulp is *nearly* exposed, a thin layer of gutta-percha can be placed over the *healthy* dentine, where it will do no harm, and the filling-material, gold or whatever else it may be, can then be placed over it. Sometimes in deep cavities, particularly in the sixth-year molars of young persons, the pulp is not fully exposed, but may become so if you explore a little too deeply with your excavator. In such a case it would never do to put over that layer of partly-decayed dentine such a material as gutta-percha. What is to be used? First a thin coating of oxide of zinc and carbolic acid, over that a layer of oxychloride of zinc, then a thickness of gutta-percha, and lastly the filling of gold or amalgam. The heat then has to go through "four stories" before it reaches the nerve. I do not want to go on record as making a practice of capping really exposed pulps, or of advocating the use of gutta-percha in contact with them.

DR. PATRICK: Did you ever save a ruptured pulp?

DR. KELLS: I don't think I ever tried it. There is one advantage about capping some pulps: in some persons you cannot get up an abscess if you try.

DR. PATRICK: The Scotch verdict I wish to introduce right here,—"Not proven." A few years ago we heard a good deal about saving ruptured pulps, and we have had it stated that some gentlemen actually performed beautiful surgical operations on pulps. I have heard gentlemen say that if a portion of a pulp, even if it was only a small part, could be saved, "for God's sake don't destroy it." We have heard that over and over again. We do not hear it so often of late years. I think we are improving. If you have an exposed pulp and treat it with carbolic acid or any escharotic, you have a clot, and a cicatrix after the clot gets through the process of

healing, if it does heal. Is the pulp capable of recovery from a rupture? The present understanding is that the office of the pulp is to produce dentine. As it produces it, it becomes reduced in size until eventually, in extreme old age, where teeth have not been decayed, the root and the tooth are alike solid. Its office is to deposit and throw out. Other bones commence to ossify in the center and go to the circumference; in the teeth the process commences at the circumference and goes to the center. When the pulp is ruptured you are on the wrong side of the tissue to perform these nice operations. If you were on the other side, I admit you might be capable of doing it. It is against all experience. You get a clot; what becomes of it? They say it is absorbed. Have any absorbents ever been shown in a pulp? They cannot be shown.

DR. ATKINSON: I have stated before assembled dentists times without number that I on my birthday filled for a Scotchman by the name of Wilson, in Cleveland, Ohio, a superior lateral incisor on the anterior approximal face, in which the pulp was exposed and bled. After the tooth was excavated the pulp was touched with creasote, and when the bleeding subsided a cap of thin gold plate was laid over the exposure and it was then filled. Exactly one month after that he came in and said, "I have lost that filling." I looked at it, excavated new retaining points, and refilled the tooth, contouring it, as I then was doing. It then occurred to me that that was the one that had had the pulp exposed. I am not exactly blind yet, and in those days I was not as blind as I am to-day. I did not then detect that there was dentine completely protecting that pulp, but that man as long as I followed him retained that as a living pulp with a reproduction of dentine over the exposure. All this about the clot being metamorphosed had better be talked about by men who have followed that clot in sponge-grafting, where it was possible to get at and determine exactly what the metamorphosis was, and get something like a mental conception of the changes of nutrient activity either plus or minus. I have pronounced strongly upon this one case only to show the propriety of capping. I concede you must have good conditions, you must have good material to work upon, good protoplasm, and then the type will take care of itself. If you will form a pocket in the territory any of the tissues will be reproduced except glandular tissue.

DR. ALLPORT, of Chicago: There is no argument that is equal to truth. Dr. Patrick has spoken of some one who had performed a beautiful surgical operation upon a pulp, or claimed to have done

so, and that the pulp had lived and become useful thereafter. At the same time he insinuated that the claim could not have been true. The older I grow, and the more I observe, the less importance I attach to the tooth-pulp after man's maturity. Though I would in no case destroy it while I deemed the probabilities strong that it could be saved, I do regard the pulp to be of less and still less importance as age advances; but I state here, as I have stated before, that I have successfully performed the very operation that Dr. Patrick scouts, and I can prove it, and that, too, by gentlemen in this hall who have seen these operations. Dr. Atkinson, as well as Dr. Haskell, has seen them, and they know that the teeth were living, healthy, and useful after it.

DR. ATKINSON: Yes, and many others.

DR. ALLPORT: But because this has been done in some few cases, I do not advocate the practice of attempting the operation in all cases, or in any large proportion of cases. I merely mention it to show the possibility of what may, under the most favorable circumstances, be accomplished. But because we can under the most favorable circumstances do certain things, that will not justify our undertaking to do that something under all circumstances. It is just here that great mistakes are made and men become unreliable practitioners. I quite agree with Dr. Kells as well as with some others who have spoken upon this subject.

The more I treat exposed pulps, the less faith I have in that treatment, although fully exposed or bleeding pulps are sometimes saved by it.

DR. PATRICK: I wish Dr. Allport to distinctly understand that I never insinuate anything. I had reference to no one in particular in my remarks. The remarks were general. If I could have singled out any member of the profession and have felt myself justified in doing so, rest assured I would have been gentleman enough to have done it. No insinuations you shall ever hear from me, sir.

DR. FREEMAN, of Nashville, Tenn.: I noticed that the statement made by Dr. Kells "that the more he attempted to cap nerves the more he did not save them," elicited expressions of applause all over the house. That did not seem to give much assurance as to the progress of the profession in the art of healing. I was taught years ago by the gentlemen before us to-day that it was possible to save exposed and bleeding pulps, and I went home thinking it was possible, and in my practice I am satisfied that ninety per cent. are saved. I have in my mind, and I have before spoken of it, a

case where, two years after treatment, I found an exposed pulp still living and bleeding, and I capped it again. Three years after that exposure it came back again still living and in good condition.

I don't know whether I do injustice to Dr. Allport or not, but it seemed to me as though he had rather weakened, and those who applauded so loudly when he said that pulps were not saved seemed to applaud at his weakening. He stated that he did not save them as much as he used to, and he did not attempt as much in that direction as he formerly did because of his failures. I don't intend to weaken so long as I know my success is as great as it is. I do not want to destroy pulps with arsenic. If pulps are going to die under treatment, I find they die more kindly under attempts to save them than in any other way, and are less likely to give trouble than those destroyed by arsenic.

DR. STOREY, of Dallas, Texas: I see it recorded in the proceedings of the Southern Dental Association, when it met at Nashville, Tenn., that there could not be found a case of pyorrhea alveolaris in that city upon which to demonstrate the treatment. If you will go to the city in which I live, I can show you five hundred cases in five or ten days. It is very probable that exposed pulps can be capped and saved in Nashville, but I cannot save them in Dallas, Texas. I went away from the meeting of this Association last year thinking I was a bigger fool than any other man that was there. I had a student from Baltimore, and I said to him, "Don't fool away your time capping pulps." I had been capping some, and it brought me business: they were back again. My student said, "They are capping them successfully in Baltimore." I said, "How do you know?" He said, "Well, they go away and do not come back any more." I said, "These will be back to you," and we have had business ever since.

As Dr. Atkinson says with reference to experiments shown here this evening, *Cui bono?* What do they amount to? I have but one capping that I use,—I use it first, last, and all the time,—and that is arsenic. Put the arsenic in to-day, take out the pulp to-morrow, and fill the root with oxychloride of zinc, and my word for it you will never have any trouble. I have treated a hundred in that way since our last meeting. Not one has come back to me, and I expect to fill one hundred next year, if I live. We do not want any caps on exposed nerves. They are of no use. What good is a nerve in a tooth after it has ached? It will ache again.

DR. CRAVENS, of Indianapolis: I feel as if I had taken a wrong train; as though I had started for Louisville and got on the train

for Cincinnati. For half an hour gentlemen have been talking upon entirely different subjects from those presented by the papers. But I am on the train, and I am going to ride with Brother Storey part of the way. In regard to the advisability of the destruction or preservation of pulps, let me say that the pulp from the time the tooth is completely formed appears to labor assiduously to accomplish its self-destruction by a process of progressive calcification. The more I study progressive calcification (and I have studied it a good deal during the past two years), and the more sections I make of teeth the pulps of which have died from some mysterious cause, the more I am convinced that after the tooth is once completely formed the pulp is of very little essential service to the future of the tooth. In old men you find that the dentine is almost insensible, showing that though the pulp is alive the tubuli have been plugged up by progressive calcification and the pulp cannot longer exercise a nourishing effect, if it ever did, which I doubt; therefore I consider that to the welfare of the tooth after complete formation the pulp is not essential.

DR. W. H. MORGAN: Reference to a paper read in the city of New Orleans perhaps twenty-one years ago would indicate that I was in favor of capping pulps almost universally, and I was very enthusiastic on the subject at that time. A few years' observation convinced me of the fact that it could not be adopted as a universal practice, but that under favorable circumstances it certainly can be made a success. I could adduce very many cases in support of that fact. The idea that the tooth has an organ in it that nature has no use for, is to me ridiculous. If she had no use for it she would remove it at once. She has use for it and she proposes to keep it there. The vitality of the dentine and enamel depends almost entirely upon the pulp. Until you can show me that a partially devitalized organ is as good as an entire living one, I shall attempt to save pulps so as to maintain the parts in their physiological condition. I want no pathological conditions that I can avoid, for a partially necrosed tooth is in a pathological condition. While it is true that there are constant encroachments made upon the pulp after the tooth has been matured, the fact still remains that when the pulp is entirely obliterated by ossification nature has in some way supplemented the duties of that particular organ, and teeth in which the pulp has become entirely ossified are still living tissues. They do not necrose. The dentine still retains its vitality. If nature proposes to remove pulps by converting them into a different tissue, I don't object, but I believe

it is always best to preserve the organ as nearly intact as possible, and anything that lowers the vitality of the teeth as the result of treatment is certainly deleterious.

DR. J. TAFT, of Cincinnati: I am somewhat surprised at the positions that have been taken in this discussion. What is the result after the destruction of the pulps of the teeth? The results vary, but immediately after the destruction of a pulp there begins a process of deterioration that will end in disintegration of the tooth sooner or later, according to the original degree of integrity of the tissue. In many instances a tooth will simply crumble away by breaking down, in from three to five years, independent of the ordinary process of decay. Every close observer will have noticed this. A tooth of the very best structure, after ten, fifteen, and usually not longer than twenty years, will be thus destroyed. While the pulp lives it is not found that the tooth deteriorates in its structure, except from disease. Dr. Atkinson more than twenty years ago filled for me a devitalized tooth, and did it so effectually that decay did not attack it again. Three or four years ago it simply broke down with no indications of ordinary decay. The adjacent tooth is wholly free from decay or disease, so far as can be determined by appearance. There are many considerations that enter into the saving of pulps. While the pulp remains, after the tooth is formed, it furnishes a continual supply of nutrient material to the dentine, thereby maintaining its life and enabling it to perform its legitimate function. The sensitiveness of dentine ceases immediately upon the removal of the pulp. That fact contains an important lesson. The function of the pulp, therefore, does not cease with the completion of the tooth. It has a very important work to accomplish after that; and who shall say when the tooth is absolutely completed? Is not the process of calcification going on in the dentine all the while after its so-called maturity? Is not the dentine becoming more and more condensed? Are not the tubuli becoming less in diameter, being filled up in time by deposition of calcareous material? I do not like to hear it said that the pulp is a worthless organ. Why does nature retain it if it is worthless? Is that her method of dealing with other parts and other organs or tissues that have become useless? Are they not cast off in some way or other? With reference to the preservation of exposed pulps, there are many considerations that have, in the main, been ignored in this discussion. You cannot treat all cases alike any more than the physician or surgeon can treat all the cases that

are presented to him in the same way. A good knowledge of systemic conditions must be possessed in the beginning, and a discrimination as to the natural powers of the patient. Some have strong constitutions that resist disease-producing influences, others succumb to influences which are in the slightest manner injurious. This is a principle recognized by every one having general knowledge of medical science. There are conditions in which it would be useless for anyone to attempt the preservation of an exposed pulp. The accidental condition in which a patient is found must govern the treatment employed. To-day one is strong and vigorous, well nourished, and with all the functions well performed. At another time the system is in such condition that it is easily thrown off its balance, and the functions imperfect. We should be able to recognize these varying conditions. Again, we must take into consideration how long the pulp has been exposed and whether it has assumed such a diseased state that it cannot be restored. In destroying tooth-pulps, avoid the use of arsenious acid. Find some other method. If the pulp is in a good condition, there is no difficulty in saving it alive by proper treatment and protection. For this delicate and skillful manipulation is required. There is a great variety of manipulative ability, and on this account varying results may be anticipated. In an operation requiring the highest skill, failures will be very likely to occur when the operation is attempted by all classes of operators. This may truly be said when we look no further than to the execution itself, but when we take into account the fact that there is very often a want of diagnostic discrimination, no one need marvel that failures very often occur. The best results can be expected only when the highest skill is employed combined with the ability to thoroughly discriminate.

Dr. E. T. Darby, of Philadelphia: I am aware that the discussion is wandering a little, but the capping of pulps is a subject to which I have given not a little attention; and as it is being so generally condemned, I feel that I would like to say a word in favor of the operation.

My first knowledge of pulp-capping with the oxychloride of zinc was a *personal* one, because the operation was performed upon a tooth in my own mouth. The pulp had become slightly exposed in the act of excavating. Oxychloride of zinc had but just been introduced as a filling-material, and it was applied to the exposure and an amalgam filling placed over it.

A few years later the amalgam filling was removed and a gold

one put in its place; the tooth was then sensitive. Eight or ten years later the same tooth decayed upon its distal surface, and before it was discovered the pulp became exposed, and pulpitis followed, showing that the pulp had survived through all these years.

The question which presents itself ever and anon, as the pulp becomes exposed by caries and in the act of excavating, is, Shall we try to save it alive, or shall we devitalize it? Now, I contend that the great majority of all recent exposures, or those made in the preparation of the cavity for filling, may be saved in a vital and healthy condition. I should consider that I was doing a wicked thing if I devitalized all pulps because they were slightly exposed.

Take for instance the incisor tooth of a young subject, the cavity large and deep, and the softened dentine extending to the pulp. As we lift off the layers of leathery decay, we come down upon a pink longitudinal line which we all recognize as the pulp. It is exposed,—slightly, it is true, but nevertheless there is an exposure. Now, I ask what will you do with such a pulp? Apply arsenic and devitalize it? I would not. I would give it a chance of salvation, and I am confident that I save from seventy-five to ninety per cent. of such cases.

Suppose another case. A patient comes with pulpitis. He has suffered all night or for days. Would I cap the pulp that day or the next? I think not. If I did so I should expect to lose it.

While I would expect to save from seventy-five to ninety per cent. of the former, I would expect to lose as large a proportion of the latter. When I advocate pulp-capping, I would have you understand that I discriminate between the recent exposure or the one made in excavating, where no inflammation has existed, and the one where the pulp has been exposed for days, it may be, and is the seat of inflammation.

A pulp may be capped so carefully and so skillfully that it will not know that it is capped, or it may be done in such a bungling manner that death will ensue. I do not profess to be more skillful in this particular than many others, but I do *know* that I save at least seventy-five per cent. of all such cases. I doubt not some of you have been equally successful where you have discriminated with the same care.

I saw only recently a patient for whom I capped the pulps in the four superior incisors at least twenty years ago. They were all exposed, and well exposed too. I have seen them at frequent intervals during the past twenty years; they are as white and as vital as any

teeth in the mouth, and respond as quickly to hot and cold as any other vital teeth. The girl was then sixteen or seventeen years of age; she is now a woman of thirty-six or thirty-seven, and her teeth are good.

A MEMBER: How do you cap them?

DR. DARBY: My method is the same as it was twenty-five years ago, with oxychloride of zinc. Sometimes I use first a layer of oxide of zinc and creasote in immediate contact with the pulp, and then the oxychloride upon that, and finally a filling of gold or other material, as the case may suggest.

An interesting case presents itself to my mind at this moment. A naval officer came to me with a large molar decayed upon the masticating surface. In removing the softened dentine a slight exposure of the pulp was made. It was capped with oxychloride of zinc, and as soon as the capping became hard a filling of gold was inserted. He went away on a cruise which lasted several years, perhaps three, possibly six. When I saw him again the same tooth had decayed on its distal surface. The pulp was exposed and capped as before. A few years later the same tooth decayed upon its buccal surface, and the pulp was again exposed and capped. It is now nearly twenty years since the first capping was made, and at least three since it was capped the third time, and unless that tooth has died since the last capping was inserted it is a vital tooth to day. I am free to admit that this is an exceptional case, and that most pulps would not bear so much capping.

DR. PATTERSON, of Kansas City: I think there is one important factor that has not been touched upon and that ought to enter into our discussion upon this question in regard to whether we shall extirpate pulp-tissue or protect it, and that is the patient. There is no question that pulps can often be saved for months or years; I do not believe there is much difference of opinion on this subject. But by which method can I give to my patient the greatest comfort and the greatest practical benefit? The fact is that capped pulps give more trouble than when the exposed pulp has been destroyed and removed and the canals properly filled. We are not disposed to look at the patient quite enough. The "objective end" of the instrument—viz, the patient—disappears from our sight too often when discussing these questions. My experience in regard to methods as between pulp-protection and pulp-extirpation is that pulp-extirpation affords the patient the greatest comfort and the greatest practical benefit. Consideration for the patient ought to be a larger factor in the choice than it is.

DR. TRUMAN: I felt when our friend from Texas was speaking like sympathizing very much with him, for I have been similarly situated for years. I am not able to say from my experience that it is possible to save seventy-five per cent. of all pulps, and I do not believe it is possible. Where the pulp has been irritated for many hours it then becomes congested, a condition which I hold it is almost impossible for an operator to overcome. If you undertake to cap a pulp at that time or at any subsequent period you are capping it in a pathological condition, which will continue until the pulp is destroyed. This will occur in my judgment in ninety-nine cases out of one hundred, if the condition of the individual favors it. Therefore I hold it to be impossible to cap under such circumstances, and when men say that they can save so many pulps it is quite necessary for them to prove it. Some of us are as capable of manipulating in these matters as others, and we cannot save pulps. Then it is not owing to bad manipulation, but it is to conditions that are against us. I believe that climatic influences have largely to do with it, as well as systemic conditions. I believe in Texas you will not be able to preserve as many pulps—for I hold that some pulps can be saved, and I will allude to those presently—as in some of the mountainous regions. In the Sandwich Islands, where disease is very prevalent, I have been told by friends that they find it impossible to save pulps. I find again from other more healthy regions that they can invariably save them. What is the cause of this? Probably it is owing to a greater amount of vitality of individuals in the latter and to depressed conditions in the former. I was struck with this view some months ago, when my friend Dr. Jack, of Philadelphia, who is a strong advocate for capping, knowing my views upon the subject, invited me to his office. I went there several times to examine cases, running from nineteen years ago when they were capped until within a year. In these cases the pulp was healthy, but what kind of cases were they? They were the best quality of teeth. It is with these very healthy individuals who resist irritation that success is secured, and the result in those cases that I refer to was that they were alive after nineteen or twenty years. This would seem to be a test case demonstrating that pulps could be saved, and it was true as far as teeth of that character were concerned, but seventy-five per cent. of all the teeth that we have to treat are of quite a different character. We cannot save that seventy-five per cent., in my opinion, and it is useless to try. I have gone through this experience from year to year, and I

cannot save pulps in a certain character of teeth or under certain systemic conditions, and I will not attempt it. Therefore in those cases in which pulpitis has begun and irritation has set in, destroy the pulp at once with arsenic. I am not afraid of arsenic, nor do I believe, with my friend Dr. Taft, that the dentine, after the pulp is destroyed, deteriorates. Of course it is dead. But what covers the dentine? The cementum. What covers the cementum and gives nutrition to that? It is the pericementum, and that holds the teeth intact in the jaw and furnishes nutrition to them. They do not deteriorate, they do not fall out of the mouth so far as my observation is concerned.

DR. STOREY: I want to make an explanation. When I say exposed pulps I mean exposed pulps. I do not mean those that have a thin film of soft dentine over them; I mean pulps exposed and bleeding.

SECTION IV.

HISTOLOGY AND MICROSCOPY.

Chairmen of Joint Committee, H. B. NOBLE, of the Southern Dental Association, and FRANK ABBOTT, of the American Dental Association.

REPORT READ BY FRANK ABBOTT, OF THE AMERICAN DENTAL ASSOCIATION.

MR. PRESIDENT,—Your Committee has very little in the way of histological or microscopical research during the last year to report upon, except the work done by Bödecker and Heitzmann upon the development of teeth, that by Andrews upon the alleged existence of two varieties of odontoblasts in the formation of dentine, and the work of Black upon bacteriology. In the former work the gentlemen have displayed an amount of patience and earnestness in their labors highly commendable. Their views are the result of eight years' hard work, and I would earnestly recommend that these writings and illustrations be carefully studied by all dental practitioners. They may be found in full in the *Independent Practitioner* for 1887–88. The work of Andrews is certainly instructive, and exhibits considerable ingenuity in attempting to account for conditions of formed dentine which all microscopists are acquainted with, though they have failed to solve the problem of its development to the entire satisfaction of all. I would recommend a careful perusal of this work.

The work of Black cannot be too highly commended. The amount of time and labor expended I know from my limited experience must have been enormous, and that we have in the ranks of our specialty a man of such marked ability is a fact that we should all feel a just pride in. I hope every dentist in the land may have the privilege of a careful study of his writings.

SECTION IV.—Continued.

The Apical Portion of the Cementum Physiologically and Pathologically Considered.

PAPER BY I. P. WILSON, OF THE AMERICAN DENTAL ASSOCIATION.

WHEN we examine the apical portion of the cementum with the microscope we find that it communicates directly with the pulp of the tooth, having but little, if any, communication with the dentine, as does the greater portion of this structure. We find, also, that this material is thicker and more vascular at the apex than at any other point of its incrustation of the root. Its lacunæ are larger and more numerous, and their canaliculi reach out to the alveolo-dental membrane on the one side, and to the pulp on the other, thereby bringing that organ in direct relation, through the vessels of the cementum, with the root-membrane. We also find, occasionally, Haversian canals in cementum at this point, especially in hypertrophied roots. The more abundant the cementum, the greater the supply of its nutrient vessels.

In pulpless teeth the peridental membrane and the cementum doubtless receive an increased supply of nutrient material; the blood-supply to the pulp having been cut off is now poured into the root-membrane, increasing its vascularity and enriching its vessels. This increased activity of the membrane doubtless accounts for the increase of nutrient material deposited around the roots of such teeth. It follows, then, that if the function of the membrane is increased to build up tissue, it is also increased in its power to tear down and carry away tissue, as in absorption, to be referred to farther on.

I need only hint at the physiological relations of the apices of the roots with the surrounding tissues, and will pass at once to con-

sider the main point of interest to which I desire to call the attention of the profession.

The devitalization of the dental pulp should not, and usually does not, interfere with the vitality of the cementum; but from observations I have made from time to time, I am led to believe that the life of the apical portion of the cementum, or that part not separated from the pulp by dentine, is sometimes destroyed with the pulp, resulting in necrosis, and ultimately in absorption or the solution of the lime-salts of the tissue of the end of the roots. We will almost always find this to be true in those cases where the canals have been filled for a considerable length of time, and yet there has continued to be a tenderness on percussion, and indeed the tooth will remain slightly sore the greater part of the time, but the sensitiveness experienced is that of *uneasiness* rather than real pain. This state of affairs is brought about by one of two causes: either the canal has not been filled perfectly to the apex, or the devitalizing effects of arsenic have been communicated through the canaliculi to the lacunæ, thereby leaving this portion of the cementum dead and inert. Here, then, is foreign matter for nature in some way to dispose of, and she sets about her tedious task in her own way, and persistently carries on the process until the work of the solution of the lime-salts of the foreign substance is accomplished.

But it may be asked, if an implanted tooth will become firm and free from soreness, and remain serviceable an indefinite length of time, when it is in every sense a foreign body, why may not a root with only its apex necrosed become equally firm and free from soreness and disintegration. For the same reason, I would answer, that an *implanted* tooth will become firmer and freer from soreness than a *transplanted* one. The one is surrounded by peridental membrane, the other is not: the one is held strictly by gomphosis, the other being cushioned by the membrane is somewhat movable. And again, a periosteal structure cannot become attached to or united with a foreign substance, but will exercise its function to the extent of its power to break down and carry away the extraneous matter.

If I am correct in my theory, it becomes a matter of the utmost importance that arsenic be employed with the greatest precaution, that the vitality of the cementum, so intimately associated with the pulp at this point, be not destroyed. When the first application fails to accomplish its work thoroughly, it is, in my opinion, dangerous practice to make a second or a third application.

I am not prepared to do away with the use of this drug altogether,

as have some of our best practitioners, but I believe that many of those incurable cases of alveolar abscess are the result of arsenious poisoning.

If by this short paper the attention of the profession, and especially microscopists, should be so directed to the pathological conditions peculiar to the apical portion of the cementum as to lead us to safer and more successful practice, I shall have accomplished my purpose.

DISCUSSION.

DR. ATKINSON: I am sorry that there are not twenty to jump to their feet when such a paper as this is read and give their opinion about it. It is an awakening so that the truth may finally find lodgment in the mind that conceived and penned that paper, and it bears so closely upon the occult movement in nutrient and denutrient activities, that I wish to make a point. That is what I have been trying to say so many times to you, when I have advocated burring out the diseased territory to the end of the roots of pulpless teeth from an eighth to a quarter of an inch beyond the end into cancellous tissue without fear; if you will get thoroughly into living territory, disinfect, and leave it, you are all safe. When James W. White was concocting a "Dental Materia Medica" I went to him with earnest affection and asked him not to put in arsenic to be used by dentists. Here is an example of a man who even yet holds on to the old-fogy notion, beginning to get afraid of arsenic, but says he can't quite give it up. That is what is the matter with the author. He speaks nicely as to the anatomy of the parts. It is certain that all the tissues come from the original protoplasmic mass, the embryonal, the indifferent corpuscles that build all the tissues. It is such a plain thing to those who have seen it that it is a marvel that men who are dealing all the time with this subject are not alive and awake to the earnestness of investigating to the last point. The reason is that we have held on to what has been written long ago, and recorded in books that claimed to hold the revelation of the truth, when the revelation of the truth comes from the inspiration of our necessities, when we have the specimen truly before us. Wilson said that came to him all in a flash. That is to say, the inspiration of the Almighty giveth man understanding; and I tell you he does not get it in any other way, and from that revelation to his consciousness, if it is the simplest or the greatest thing, it is revealed to

him as a gift or a favor. We do not understand the difference between what is called inflammatory process and the ordinary activity: that is also oxidation or oxygenation, just the same as the destructive one is, but it is a different degree of the building up of tissue. He spoke of the cement-corpuscles that lie directly against the mesh of vessels and nerves that have their outline or sheath made up of white connective-tissue corpuscles that have to be fed and nourished to keep the machinery in good order, and that is the mass way of men who do not follow out the process of change by reason of the proximity of arsenious acid. How does the arsenious acid act? Who knows and who cares, only in the mass general way of how much money he can get out of it? The commercial spirit is bearing us down so that the light within us is darkness; and the Book says, "If the light within you be darkness, how great is that darkness," and we see how great it is, that men take hold of these things fearfully because they do not know, and they have not the honesty to say they do not know and turn their faces to the light that the angels may reveal truth to them. They want to divide everything that is organic and take it away from chemistry. There is a chemistry of organism and there is an organism of chemistry, and they do not see that the affinity existing between the arsenious acid and the semi-fluid parts of the pulp depends altogether upon how much there is there, whether there is a definite measure so as to make it coagulum, for if you get the legitimate quantum of arsenic to make an arseniate of the albuminous structure you have the prettiest filling for a root that can be conceived. How does the abscess occur if the pulp has been destroyed with arsenic?—unintentionally I hope, for I pray God to forgive every man who is so in the dark as to willfully kill babies that they may have a funeral.

DR. STOREY: Amen.

DR. ATKINSON: Let us trace that and see where the retrograde metamorphosis takes place. There is now in the minds of the best men who are engaged in micrological research a very strong conviction that there is a microbe which enters into this territory and sets up a retrogressive ferment there, until the false affinities shall have quartered these little insects there and raise Ned; and then they will tell you there are three or four kinds of these microbes that are capable of producing pus, and talk learnedly and say nothing, and convince the listener that on what they do say they have not had the first illumination on the real metamorphosis that is going

on. What is the practice, and what is the evidence? I don't want to tell you of the sins I have committed in my life. One of the old prophets said he prayed God that he might be delivered from the memory of his former sins. These are better days than that. I am a little better than the prophet, for I have had a better illumination through the mercy of the power that moves us. I do want to remember my former sins, that I may avoid repeating them; I want to cancel them and get all the good out of the mistakes that I have made, and be fitted to do the work that I am given on earth to do. How shall we get hold of these things? Only by endeavoring with earnestness and simplicity to ask for the truth. How do we get any knowledge of this? Either by direct illuminations or else by many mistakes and observations. How many people in this assembly have extracted roots of teeth and examined the ends to discover whether they were rough or not, so as to see whether they had made a mistake in extracting them? If they had had the illumination to cut through so as to get at the end of the root, where the retrogressive metamorphosis was, and bur it all out and wash with even simple salt and water, and hold their finger on until a plug formed, and kiss their patient good-by, the thing would have been done. I am very glad the essayist wrote that paper, and I want to tell him and the rest of you that he is simply following in the line that I have trod until my feet and soul were sore over the mistakes that I have made, to come to the firm conclusion he has manifested, the old hanging on to the garlics and onions of Egypt, that he still wants to use the devil a little more, that he may sin so as to repent more heartily.

DR. STOREY, of Texas: Before grandpap sits down I wish he would tell us how to do right. I wish he would tell us how to repent of these things. He has said a great deal here to-night, but it is like the old woman when she sent for the doctor to see her child, and the doctor put on many airs and said, "Madame, it is a gastric mucous irritation conveying a sympathetic titillation to the epithelium of the Schneiderian." She said, "There now, I said that is just what it was, but Betts she said it was worms." He has not told us how to do right. These pulps are cutting up; how are we going to rid ourselves of them? Are we going to leave them in there? He says we sin every day. I agree to that; I admit it. He has prayed the Lord to pardon us, and I have said amen to that, but he has not told us how in a single sentence we are to fight this trouble, except where a tooth was extracted that had a roughened root. He

is all right in that, but he has not told us, if there was a decomposing pulp in there or one that was aching, how we are to get it out without putting arsenic in. If any man will tell me a better plan, I will adopt it. I have been for more than twenty years trying to learn a better way, and I am here all the way from Texas now to learn a better way, and grandpap has "splunctified" here to-night for an hour, and still has not told it.

DR. ATKINSON: This is the kind of a camp meeting that I like. I have prayed over hard sinners many a time and they have not repented. I have told so often that I supposed there was not a man who could read English and had seen a dental journal who did not know what to do when a tooth was tender, which is of course because there is pericementitis. What does that indicate? Most dentists will tell you it indicates a dead pulp. A great many dead pulps have that. Millions of slumbering volcanoes are in the mouths of so-called healthy people that upon the slightest disturbance of their health will be liable to break out into an abscess. I did not suppose it was necessary to go through all the A, B, C, to men who were practicing that every day. If it is tender and a little pressure comforts it, continue that pressure until the comfort begins to be discomfort, and then when that comes lift up the lip and with a sharp bistoury cut through the mucous membrane, through the gum, through the external wall of the alveolar plate, through the alveolar plate to the cancellous portion with your bistoury, through the connective-tissue membrane that is called the pericementum, and cut into the cementum, through the cementum into the dentine, but do not go through the end of the root lest you should destroy a sick pulp; draw down and press hard enough, and you will feel that the cementum will act like india-rubber on your sharp bistoury, until you come two-thirds of the way down, but do not cut through the margin of the gum or through the margin of the alveolar plate nor the dental ligament, and when it has bled enough ask the patient to shut his teeth. If you have struck the seat of the retrogressive change the pain will be gone and your patient cured. The angel world is so full of light and intelligence that it can be revealed to anyone if they will ask any question respecting the whole range of metamorphosis, from the first arrest of the neural current that sets up the office of congestion, that afterwards becomes stasis and oxygenation and all those processes from which the inflammatory process comes, and every one of the steps we have been over so many times that it is as familiar as A, B, C. I have told you

nothing about putting on remedies. They are adapted in different degrees, and we have to study a long time before we are able to discriminate which is the best thing to do. Generally the best thing to do is the application of whatever will comfort the inflammatory locality. If cold comforts it, use cold; if hot comforts it, use hot; but as you love your life and truth don't use anything that is warm. Warm applications are abominable,—so abominable that the man that has any religion in dentistry would avoid it as he would sin.

DR. STOREY: Now, grandpap, you haven't told me a thing about how I am to get rid of that aching pulp. That is what I want to know. You run an engine about ninety miles a minute, and take a sharp-pointed bur and put it there, and you will accomplish the work while the angels are coming down to inspire you. You let the drill go, and no harm will come of it. I have done it many times, and expect to do it many times more if I live long enough. I want to know, when that tooth is aching from an exposed pulp, what to do.

DR. ATKINSON: And I have not told you?

DR. STOREY: No. I have got to get that pulp out.

DR. ATKINSON: I have many things to say unto you, but your ears are dull of hearing. I thought everybody in the house did hear. I said, when the pain was there, to apply hot or cold until it was made comfortable.

SECTION IV.—Continued.

Odontoblasts in their Relation to Developing Dentine.

PAPER BY FRANK ABBOTT, OF THE AMERICAN DENTAL ASSOCIATION.

SINCE Virchow, in 1850, announced the opinion that the intercellular or basis-substance in all varieties of connective tissue, which he termed "connective-tissue substances," is a product of secretion, many histologists have adopted this view. Even to-day we meet with publications, both in English and German, holding fast to this secretion theory. It is, we admit, apparently the simplest of all theories, since it merely suggests that, at a given period of its existence, a cell should give out, from its contents, a certain amount of liquid, which eventually might become solidified, and even receive the lime-salts, forming the hard tissues such as bone, dentine, etc.

Fortunately, in 1861, we learned through the studies of the late Max Schultze that all intercellular or basement substances are products of the cells, inasmuch as a certain number of such cells would die, be transformed by a chemical process—not fully understood—into glue-yielding substance; whereas a certain other number of the cells would remain unchanged, and represent what have been called bone-cells, cartilage-cells, or connective-tissue cells in a general way.

An intermediate position between the two extreme views was taken by Beale in 1860, who claimed that the intercellular substance is a product of the transformation of the peripheral portion of the cell; so much so that an original large cell would, at its periphery, be converted into glue, or, as Beale has it, into "formed material," while the central portion would remain forming or living material, much reduced in size, and now termed a "connective-tissue cell." This latter view is still held by Klein, of London.

It was in the basis-substance of cartilage that Fuerstenberg, some forty-five years ago, by some chemical treatment of this tissue, dis-

covered lines of demarkation between cartilage-cells, which Virchow afterwards baptized "territories." Obviously, territory means a central cell with a given amount of surrounding basis-substance. According to those who held to the secretion theory, the amount of basis-substance around the cell would altogether be a product of secretion of the central cell. Originally, in the embryo, the cells lay closely packed together, and, once having begun to exude the intercellular substance, became pushed apart, and eventually widely separated from one another, as seen in fully developed cartilaginous tissue. According to Beale, the whole territory was originally a large cell which in time became much reduced by the solidification of its peripheral portion.

Max Schultze claimed that the territory was originally protoplasm, or composed of a group of embryonal or indifferent corpuscles; the peripheral portion of the protoplasm, or the embryonal cells, becoming transformed into a glue-yielding basis-substance; during which process they became deprived of life, the central portion only remaining alive and retaining its shape as a cell. This is the theory held to-day by most advanced histologists, and we consider it correct in its main features.

In contradistinction to the "secretion theory," this has received the name of the "transformation theory." In 1873, C. Heitzmann added a feature of importance to Schultze's transformation theory. After having demonstrated that the basis-substance was *not* altogether devoid of life, but traversed by a net-work of living matter (which view was afterward corroborated by S. Stricker, of Vienna), he arrived at the following conclusions concerning the development of a territory: A territory was originally protoplasm, or made up of a number of protoplasmic bodies, the so-called embryonal or indifferent elements. Protoplasm, wherever found, is traversed by a reticulum of living matter; and, since embryonal corpuscles are protoplasm, they are inter-connected by delicate offshoots of living matter, which establishes a continuous net-work throughout the territory. Whenever, in the process of development of a territory, its peripheral portions are converted into glue-yielding basis-substance, the contents of the meshes alone are chemically altered, while the reticulum itself remains intact.

According to this idea, nothing but a liquefaction of the contents of the meshes is required, in order to render an already formed basis-substance protoplasm again. Such oscillation between protoplasm and basis-substance we invariably observe in the development of

hard tissues; the territories becoming, after each return to the embryonal or protoplasmic condition, more perfect, more solid, and more regular, as we see especially in the development of cartilage and bone.

Let us now apply the view here advanced to developing dentine, a tissue which we may consider as a highly perfected one, surpassing in its individuality and refinement of structure any of the ordinary osseous formations. In the dentine itself there are no cells; all we see is the fibers of living matter, the tenants of the canaliculi and their offshoots passing into the basis-substance. The main mass is not cartilaginous, as was previously supposed, but glue-yielding, especially dense and indestructible immediately around the canaliculi, and infiltrated with lime-salts. The only formations deserving of the term "cells" are the odontoblasts, those peculiar, elongated bodies (of a shape and size to remind one of columnar epithelia) usually seen at the periphery of the papilla in developing, and at the periphery of the pulp-tissue in developed teeth.

We know of these peculiar protoplasmic bodies, that they send offshoots upward into the dentine (the dentinal fibers), offshoots laterally connecting one with another, and other offshoots downward, uniting them with the medullary elements of the papilla.

The first to see and describe all these offshoots was Franz Boll, in 1868, and he was corroborated by Waldeyer, in 1869. Before these offshoots were known, attempts at explaining the formation of dentine were made, first by A. Kölliker, in 1852, in his handbook of histology. On page 385 he says, "In the formation of dentine not the whole pulp is concerned, but only its outermost layer of epithelium-like cells, which, by a continual prolongation of the original cells, *under a continuous multiplication of the nuclei*, apparently keep up the same thickness.

"I am not willing to maintain that one and the same cell is sufficient for the whole duration of the formation of dentine, for I consider it as quite possible that, from time to time, the dentine cells are replaced by others forming at their inner side. What I deny is, that the whole pulp is transformed and ossified from without inward."

Kölliker, at that time, knew nothing about the presence of dentinal fibers. In order to explain the formation of the dentinal canaliculi he, on page 386, discusses the following three possibilities:

1st. The canaliculi are the remnants of the cavities of the dentinal cells, which, in the process of ossification, become thickened and hardened in their walls, but are not perfectly closed.

2d. The canaliculi originate from the nuclei of the dentinal cells, which elongate and coalesce, but retain their central cavities.

3d. The canaliculi are produced by a process of resorption in the previously homogeneous dentinal tissue, in a manner analogous to the formation of the Haversian canals, or the canaliculi in the cementum.

Of these three possibilities, Kölliker considered the first as the most probable for the formation of the main canaliculi, and was convinced that the third possibility alone can explain the origin of the fine branching canaliculi. He distinctly states that no other tissue is concerned in the production of dentine but the cells which later were dubbed odontoblasts, and that these, by a successive taking up of the lime-salts, become dentine. He, therefore, as early as 1852, although upholding the secretion theory unswervingly from that time up to date, for the formation of dentine adopted the opposite or transformation theory. About ten years later he and John Tomes discovered the dentinal fibers, and, with their acknowledged presence within the canaliculi, and their connection with the odontoblasts, the difficulties in explaining the formation of dentine have considerably increased.

Are the dentinal fibers remnants of the central portion of the odontoblasts, whose lateral portions become transformed into basis-substance? Are the dentinal fibers formed between the odontoblasts, after the latter have become basis-substance? So great, indeed, seemed the puzzle, that quite recently R. R. Andrews deemed it advisable to reiterate a previously expressed opinion of E. Klein and others, that there are two sets of odontoblasts, some with broad bases which become basis-substance altogether, and others pear- or spindle-shaped, with long projections, which become the dentinal fibers. These latter they termed "fibril-cells."

It would seem to require but a very limited amount of histological or microscopical experience to satisfy oneself of the untenableness of these views, as, with not a very high power, projections may be seen running from every odontoblast into the canaliculi of the formed dentine, some giving off one, some two, some three; and even as many as five offshoots have been seen arising from a very broad end of an odontoblast, and penetrating the canaliculi. The "fibril-cells," therefore, are nothing but narrow wedges between broad-based odontoblasts, especially numerous where the periphery of the papilla forms a sharp curvature, such as on the pointed cusps.

After eight years' study, Bödecker and Heitzmann have an-

nounced that the odontoblasts are not direct dentine-formers; that they break up into embryonal or medullary corpuscles shortly before the appearance of the basis-substance, which at first appears without lime-salts; and that the dentinal fibers, originally in connection with the odontoblasts, of whatever shape, after the breaking up of the latter into embryonal corpuscles, become situated between these, and so remain in their respective canaliculi, even after the calcification of the dentine is accomplished.

From personal studies I am fully convinced of the correctness of this position. Unquestionably there are portions in a developing tooth where the odontoblasts lie unbroken against the formed dentine. This we consider a condition of rest for the time being. For, more frequently, we see the odontoblasts split up into smaller portions of protoplasm which we term medullary or embryonal elements, and whenever this is the case we see the fibrils passing into the already formed basis-substance of dentine, between the rows of embryonal corpuscles. This explains to us why the living matter present in the medullary corpuscles remains unaltered, even after the formation of the glue-yielding basis-substance, and its infiltration with lime-salts. This explains, further, why the dentine, after the liquefaction of the basis-substance, in pathological conditions, breaks up into medullary or inflammatory corpuscles, a fact that I observed and first described in 1879, in the process of caries of living dentine, and which was later corroborated by Bödecker in his studies upon ebonitis.

Several questions, however, require our close attention in the history of the development of dentine. One of these is, Are the odontoblasts absolutely necessary as a pre-stage to the forming dentine? And secondly, How is it that the odontoblasts produce a continuous mass of dentine from the periphery to the pulp, if they are converted into basis-substance in layers? For we know that the dentine is only in exceptional cases stratified, and one would expect that such lines of stratification would be of common occurrence if one row of odontoblasts after another were converted into basis-substance.

As to the first question, we are unable to give a positive answer, but take it for granted that they are. We often see, at the summit of the papilla, medullary tissue bordering the already formed dentine, without a trace of odontoblasts. Through the researches of John Tomes, we know that the odontoblasts originate by coalescence of medullary corpuscles of the papillary tissue; and we know, furthermore, that the odontoblasts again return to the medullary condition

before becoming infiltrated with lime-salts. It appears possible that previous odontoblasts have been transformed into medullary tissue, and no new ones produced at that particular period.

To the second question, whether or not the odontoblasts form a single row for the time being, thus involving an interruption in the appearance of the basis-substance of the dentine, a positive answer can be given, in accord with the observations of Kölliker in 1852, above quoted. The difference, however, is sufficiently marked between his and our views to, in our judgment, demand attention.

He claims that there is but one row of odontoblasts capable of producing dentine, and that these become continuous by a proliferation of the nuclei of the original single row, and their elongation thereby. He distinctly denies that the pulp as a whole could be converted, layer after layer, into odontoblasts. We, on the contrary, agree with John Tomes in the view that the medullary corpuscles of the papillary tissue are progressively converted into odontoblasts, which explains the fact that, with the advancing growth of the dentine, the bulk of the papilla diminishes. We add another point, viz, *that each odontoblast, while being reduced to medullary corpuscles at its distal or peripheral end, is being added to by an attachment of medullary corpuscles of the papillary tissue at its proximal or central end.*

Undoubtedly there are periods of comparative rest, in which a fully developed odontoblast borders the dentine, and dips into the papillary tissue with sharply defined contours, with its narrow and pointed end. As soon, however, as the building of dentine is resumed, the peripheral end of the odontoblast is seen to have divided itself into medullary bodies again, and, simultaneously, rows of medullary corpuscles are superadded to the opposite or central end.

A beautiful illustration of this process may be seen in the developing tooth of a pig's fœtus, ten centimeters long (see Fig. 1). Here we see several rows of odontoblasts, bordering the non-calcified portion of the basis-substance of the dentine. At that portion in which unchanged odontoblasts stand against the dentine, others are attached to the uppermost row, likewise in full development. This we consider as a condition of comparative rest. At that portion, on the contrary, in which the odontoblasts are replaced by medullary corpuscles toward the dentine, without a distinct boundary-line between the two, we see rows of medullary corpuscles attached to the inner ends of the odontoblasts, whereby the transverse diameter of the odontoblastic layer is noticeably broadened. In the former instance, the layer of odontoblasts is fairly well marked toward the papillary

FIG. 1.

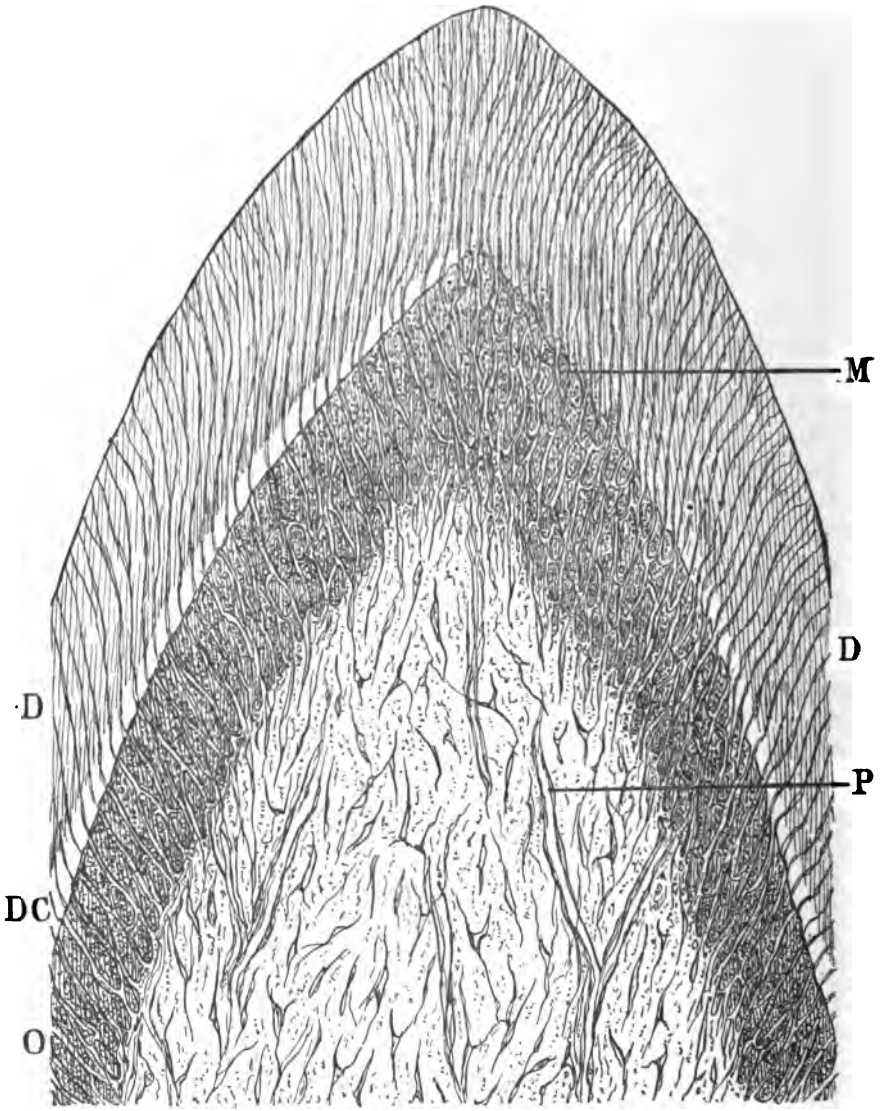

FIG. 1. Tooth of a pig's fœtus 10 centimeters long. *D, D*, Calcified dentine. *D C*, Non-calcified dentine. *O*, Row of odontoblasts, partly fully formed, partly forming. *M*, Odontoblasts broken up into medullary corpuscles in the process of formation of dentine. *P*, Vascularized myxomatous tissue of papilla. × 200.

FIG. 2.

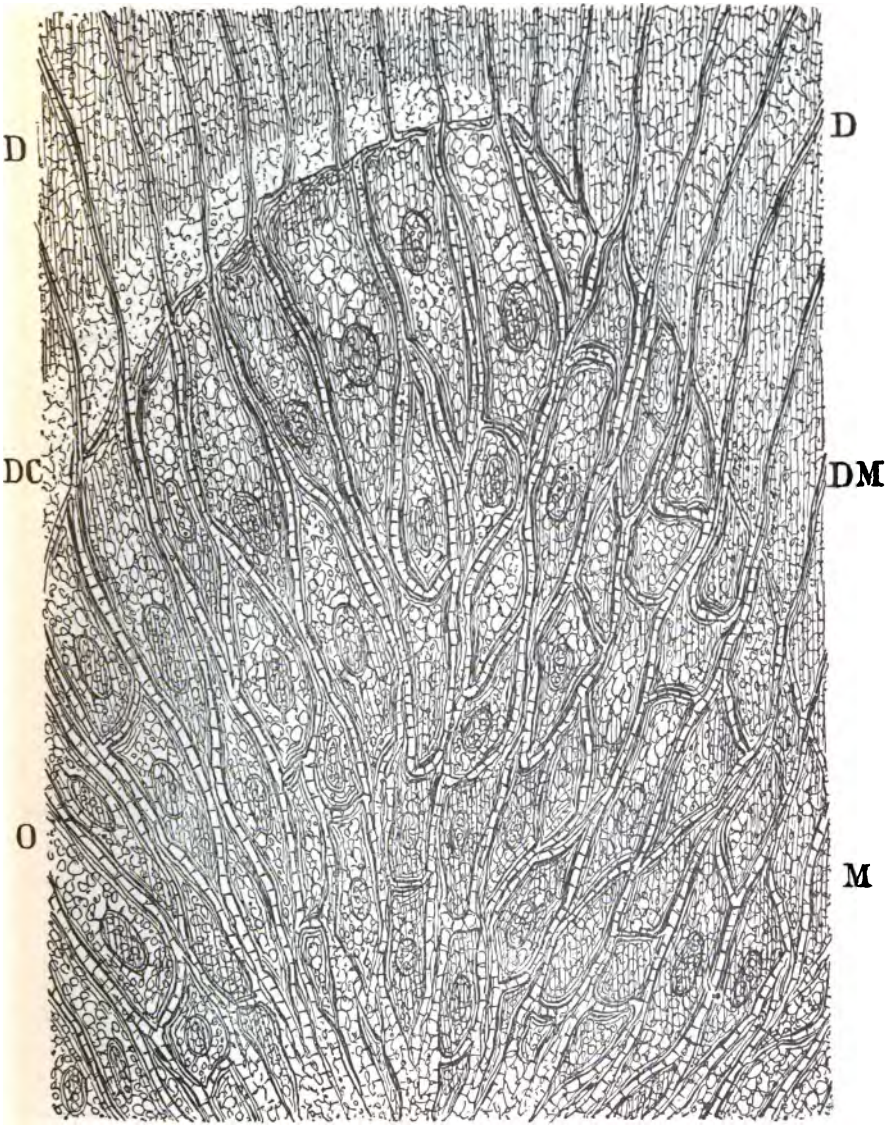

FIG. 2. Tooth of a pig's fœtus 10 centimeters long. *D*, *D*, Calcified dentine. *D C*, Non-calcified dentine. *D M*, Dentine in the process of formation from medullary corpuscles. *O*, Odontoblasts in multiple rows, spindle-shaped elements wedged in between the broad odontoblasts. *M*, Medullary corpuscles arisen from odontoblasts, such corpuscles also attached to the distal ends of the odontoblasts. × 800.

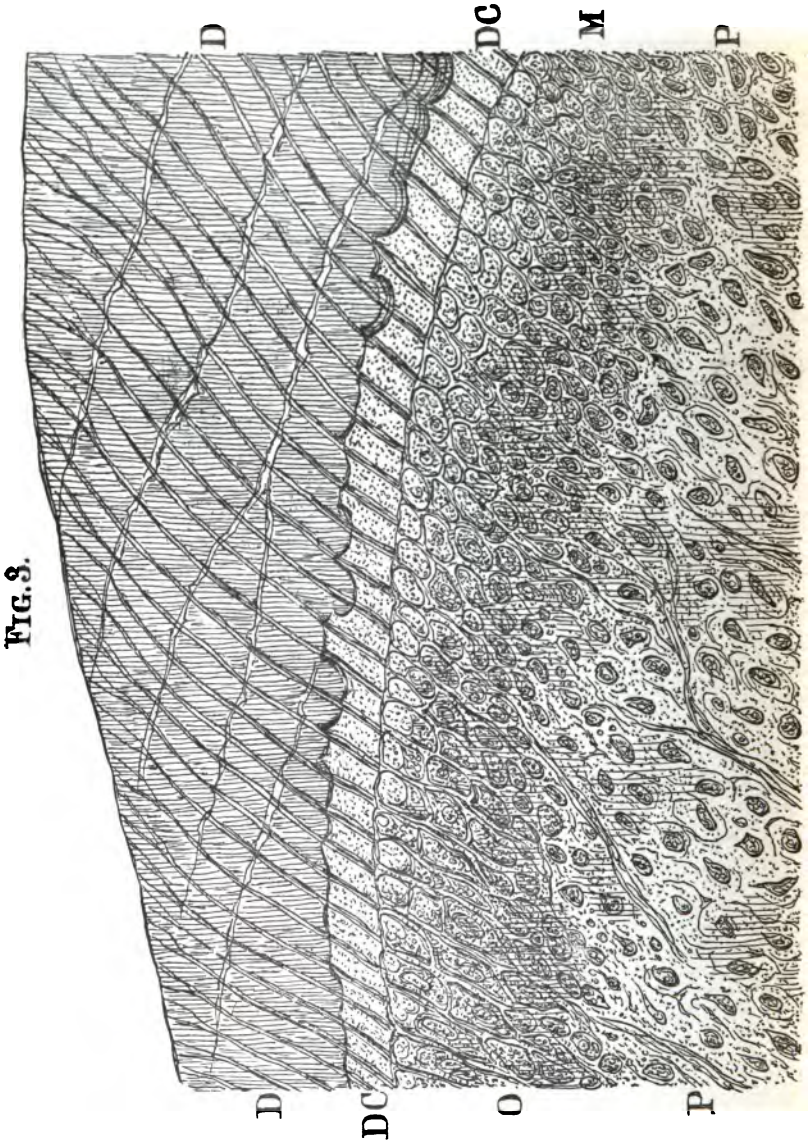

FIG. 3.

FIG. 3. Tooth of a human fœtus, 6 months. *D, D*, Calcified and stratified dentine. *D C, D C*, Non-calcified dentine, the border of the calcified dentine being marked by globular formations. *O*, Odontoblasts splitting into medullary corpuscles toward the dentine, and showing rows of such corpuscles at the distal ends. *M*, Medullary corpuscles ready for the transformation into basis-substance of dentine. *P, P*, Myxomatous tissues of papilla. × 400.

FIG. 4.

FIG. 4. Tooth of human fœtus, 7 months. *D D*, Dentine calcified. *D C*, Non-calcified basis-substance of dentine, close above the capillary blood-vessels, broadened and visibly made up of medullary corpuscles. *C*, Capillary blood-vessel in transverse and longitudinal section. *M*, *M*, Medullary corpuscles ready for infiltration with basis-substance. *M O*, *M O*, Medullary corpuscles arranged in rows for the formation of odontoblasts. × 800.

tissue; in the latter instance it is indistinct, the odontoblasts blending with the papillary tissue.

High powers of the microscope illustrate still better this claim (see Fig. 2). At the same time it becomes evident that the dentinal fibers, originally attached to and connected with the odontoblasts, become situated between the medullary corpuscles as soon as the former are converted into the latter. Wherever we notice rows of medullary corpuscles at the inner ends of the odontoblasts, delicate fibrillæ are seen coursing between their rows or groups.

Since, according to our views, the myxomatous basis-substance of the papillary tissue is supplied with living matter, the same as are the so-called cells, there is no difficulty in explaining the origin of new protoplasmic bodies from the previous myxomatous basis-substance, for the benefit of continuous additions to the odontoblasts.

The facts just described are well illustrated in the developing teeth of a human fœtus from six to seven months old (see Fig. 3).

The cusp of the dentine shows stratification, although no odontoblasts are seen at the summit of the papilla. At the sides of the cusps, odontoblasts make their appearance, broken up into finely granular medullary corpuscles, toward the non-calcified basis-substance of the dentine, and augmented in their bulk by rows of glistening, almost homogeneous, medullary corpuscles, toward the papillary tissue. Occasionally we meet with a basis-substance of dentine not yet calcified, and still exhibiting its composition of medullary corpuscles (see Fig. 4).

Upon studying this specimen, all doubts as to the origin of the basis-substance of the dentine must vanish. All previous attempts at explaining how the odontoblasts are converted into dentine must prove futile in the face of such a specimen. Although we admit that such a plain instance is only exceptionally seen, we thought it to be so instructive and so convincing that we had an illustration made with a very high power. With the facts advanced, a hitherto mooted question seems to have found solution.

As to the question why dentine in all its stages of development appears to be a continuous mass, and but exceptionally interrupted by marks of stratification, the explanation is that the odontoblasts themselves are continuous. Not the original odontoblasts are preserved and augmented from the periphery toward the center; but all that is converted of an odontoblast into dentine, at its peripheral portion, is made good by the addition of medullary corpuscles at their central ends or portions, from the tissue of the papilla, both the protoplasmic bodies and the basis-substance.

DISCUSSION.

DR. SUDDUTH, of Philadelphia: That the views presented in one portion of the essay just read are entirely new, is not questioned. That they are not accepted by the majority of histological workers the world over, also goes without dispute. The main question that was brought up was that of the difference between secretion and transformation. Dr. Abbott holds that all the hard tissues of the body are the products of transformation rather than of secretion. From my studies, which have extended over several years, with my time almost exclusively given to it, and through a varied line of work in dental anatomy, both human and comparative, I have come to the conclusion that the manner in which hard tissues of the body are developed and deposited furnishes positive proof that their formation is a process of secretion, rather than transformation. That there is a deposition of the lime-salts into the basis-substance we all hold in common without doubt, but the point at issue between us is the agency or the connection of the cells which we have termed osteoblasts in the development of bone, odontoblasts in dentine, and ameloblasts in enamel. Dr. Abbott does not take into consideration the difference between the cancellous and the cortical portions of bone. In the cortical portions of bone we know that the number of bone-cells is much more limited than in the cancellous portion. In the cancellous portion the territories are filled with bone-cells, surrounded by a comparatively small proportion of investing bone. In the cortical portion we have a different structure, a layer or sheet of hard bone in which are found comparatively few bone-cells. The difference in the formation of these two structures is dependent upon the different ways in which they are *secreted*. In the cancellous portion they are secreted in territories, each one surrounding an osteoblast or bone-builder, each cell having a separate individuality, secreting around itself the hard tissues which form the cancellous portion; but in the cortical portion we have a sheet laid down, because in that case the osteoblasts are not scattered indiscriminately throughout the tissue, but form a membrane underneath the periosteum and the bone is laid down in layers, and consequently we do not find the same amount of organic material which is observed in the cancellated portion. Another thing, the regularity with which bone is secreted shows that there is a power behind,—something that directs the formation of this portion. We do not have bone developed indiscriminately through-

out the body. It is developed in certain lines and certain places; and so with dentine, there is a directing agency which controls the deposition or secretion of the lime-salts. In cartilaginous ossification we do not have development of bone beginning until the capillary vessels have penetrated into the cartilage. Following the penetration of the capillaries there is an exudation of white blood-corpuscles and the development of the cells which govern the secretion of the bone. Bone is not developed indiscriminately, but is laid down in regular layers, dependent upon the controlling agency of the osteoblasts. And so it is with dentine.

There is one point I have noticed in following the line of work done by Drs. Abbott, Bödecker, and Heitzmann, and that is that they have almost altogether ignored the nuclear structure of tissue. In the development of dentine this one point is so very essential that I would like to make some illustrations on the board if you will bear with me. [Dr. Sudduth here explained some drawings which he hastily made.] The fibers which pass into the dentine are shown beautifully in the drawings that have been passed around. The form of the odontoblasts does not make any essential difference, they vary so in shape. The form of the cell is dependent upon the pressure of fellow-cells. The tendency of protoplasm is to assume a spherical form, but where cells are growing rapidly they assume many different forms. They are columnar, spherical, and dumb-bell shaped in many instances. The point I would make is this: that in all these cells we have a nucleus, and that nucleus is always found at the end of the cell farthest from the point where the dentine is being deposited. If Dr. Abbott's theory of the breaking up of these cells into globular tissues were correct, we should find at the point where the calcification was going on that we would have some of these nuclei at that end. The development of dentine I have studied in all its phases, from the very smallest embryo, when the whole embryo was only three-eighths of an inch in length, taking the jaw from that embryo and carrying the observations through in no less than nine different series, and I find in good preparations that the odontoblastic layer is the same all the way, that in all cases where dentine is being developed we have these perfectly formed layers of odontoblasts and the nuclei situated in the distal ends. I am not surprised that Dr. Heitzmann and Dr. Abbott have been misled in this matter. Dr. Heitzmann and Dr. Bödecker were kind enough to invite me up to their laboratory, and they showed me some specimens, and I say candidly, with all my ex-

perience in histological research, that I do not see how, from the specimens that were there shown me, they have been able to draw any conclusions whatever. In staining tissues we do not destroy their structure; we only bring out the details through the chemical reaction of the different portions of the tissue upon the staining agent. In the preparation of these tissues, if you would take the trouble to stain them, you would see plainly where the differentiation is marked between the nucleus and the body of the tissue,—you can tell most positively the difference between the two.

Dr. Abbott has made use of the expression time and again, "of the return of these tissues to their embryonal condition." They are all the time in an embryonal condition. We are not able to study the development of dental tissues after they pass from an embryonic state. They are embryonic tissues from beginning to end, so far as we make use of them in studying the development of the teeth. It is only at a later date, when the tissues have become fully developed, that this term could be used practically.

Then, again, the point that Dr. Abbott refers to "of the breaking up of dentine into these territories of embryonal tissue." At a recent meeting at Boston we had some of the finest work I have ever seen done in photo-micrography. Dr. Miller had sent some slides of decayed dentine showing the dark territories that Dr. Abbott speaks of, and in those territories, as demonstrated by the photo-micrograph, it was shown that they were filled with masses of bacilli, and the bacilli were well marked. Instead of being embryonal corpuscles, they are simply aggregations of the bacteria that cause decay.

DR. ABBOTT: If we did not differ in opinion we would never learn anything. Notwithstanding we look at the same specimens, through the same glasses, we see and understand them differently. It seems curious that this can be so, but it is nevertheless. No two persons see a thing in the same way or with the same understanding of it, no matter whether it be microscopical or macroscopical. They are all looking at it with a different idea, and that idea is to a certain extent subjective. The subject of the difference between the transformation and the secretion theories is old, of course, and one as well as the other has its advocates. I have never been able yet to satisfy myself in regard to the truth of the secretion theory. I have not studied so much in this line as Dr. Sudduth has done; that is, I have never studied all kinds of tissues and all kinds of embryos "from three-eighths of an inch in length up," as he has done,

and for that reason I am not able to pronounce so emphatically upon the matter as he is. But in this as well as in everything else there is a little good common sense to be exercised, that must be brought to the surface by every person studying, or he is bound to make a failure of it. Theories, so far as the formation of dentine is concerned, contemplate the formation of a row of odontoblasts at the periphery of the papilla, the distal ends being in conjunction with the ends of the ameloblasts which are to form, on the other side, the enamel. That is where the calcification begins, both with the enamel and the dentine. Now, the secretion theory seems to be that of secreting the lime-salts as well as all substances which go to form dentine by this one row of odontoblasts; and as the secretion goes on it falls back and eventually is found around the pulp in a perfectly formed tooth, in a dense small form, as compared with what it was on the periphery of the papilla at the beginning. As stated in the paper, Kölliker in 1852 concluded from his studies that this could not be the case, but that the odontoblasts became dentine eventually, that the nucleus, so well marked in his opinion, splits up again and again, by which means the odontoblasts are increased in length, calcification going on from without inward until the final formation of the dentine. This did seem at that time, and has for many years seemed, in the minds of many a more rational view even than that of the secretion theory. Another idea has been advanced, I believe by Goodsir, under the heading of the formation of teeth, that the odontoblasts row by row become calcified, that the secretion or deposition of lime-salts begins at the center, around or in the nucleus (the nuclei are located by him in the center of the odontoblasts), and works its way toward the periphery of the odontoblasts, and eventually they become a portion of the calcified dentine, with the dentinal fibers running between them. This view has been denied by many. It was remarked by Dr. Sudduth that the nuclei in the odontoblasts are always found at the distal end, that is, the distal end from the forming end of the dentine, the end towards the papilla, I take it, and that there was nothing in the way of nuclei anywhere else to be seen. With high powers of the microscope you can discover in every single odontoblast a reticulum, and that reticulum has in it a mass of granules; in other words, it is full of little nuclei which were originally the nuclei of the medullary elements from which the odontoblasts were formed. All it requires is simply magnifying power enough, and it can be seen. That being the case, as I remarked, the distal end of the odontoblast breaks up

into its medullary condition again. The formation of the odontoblast was simply a provisional step in the development of dentine, it is only carrying out the type of the tooth, the formation of that particular organ. All other tissues or organs are built in the same general manner.

The doctor was more fortunate than I was in being able to attend this recent meeting in Boston. They do things in Boston wonderfully well, sometimes, and I have no doubt they did wonderfully well on this occasion. I have no doubt they showed some excellent specimens. I have no doubt they showed some wonderful specimens of caries of teeth. Probably every man who went there and examined them was thoroughly convinced of the correctness of the deductions drawn from them by the person who showed and explained them. Men are always bound to agree when only one side is represented. A lot of specimens are sent out from Europe. We cannot prepare specimens as well as they can in Berlin. They are all miserably stained. They are poor, miserable things in every way you may look at them. But still we manage to find out something notwithstanding, and we believe in American industry. What are the facts in reference to every specimen that has been presented on this side of the Atlantic, or on the other, in reference to the decay of dentine? There is a layer of tissue between that inhabited by these little micro-organisms and the perfect dentine, the conditions of which have never been explained by Dr. Miller or anyone else except upon the reaction theory. You can take any specimen you please of their own production, and put it under a microscope. They may stain it as much as they please, and still you will have exactly the same thing. I have been over this myself. I have been studying it very carefully for a great many years, and I think I know something of the way caries is going on. In the process you take, for instance, a section of a tooth with a cavity in it, which would be represented by this curved line. Here would be the outer portion of the tooth, and this would be a cavity in it. This portion is to a certain extent broken up, or is débris that would be taken out of the cavity by a syringe with a little water; then you will find that the first layer of this dentine, or carious substance, is extremely soft and is filled with micro-organisms, micrococci and leptothrix principally. You may find sometimes what is termed a fully developed bacterium. You go in a little deeper, and you find the micrococci there as they appear in decaying dentine; they look like little granules. These, by a process of staining, exhibit a

certain color different from any of the surrounding tissue. So we come to the conclusion that micro-organisms have penetrated the dentine to a certain extent. When you have gone to a certain depth, you will find that running off into the dentine here would be a peculiar yellow stain that everyone of you has seen if you have split a carious tooth in two after you have extracted it. What is this condition? What does it mean, and what is represented by it? It is not filled with organisms at all,—not one to be seen, because there is no staining. There is an amount of tissue which is broken down or disintegrated, and is not perfectly formed dentine. What is the cause of this? We know that in dentine there are some twenty-eight parts in a hundred of organic matter, some portion of which—perhaps fifteen parts or less of it—is living matter; the rest is composed of the matrix which holds the lime-salts, called the glue-yielding basis-substance. If living tissue is not subject to irritation, and will not respond to it in the way of inflammatory reaction, what will it do? What does it do? What I claim in this process is that all this tissue beyond where the organisms may be found, which is disintegrated, is a disturbance of the formed condition of lime-salts; they are misplaced by the inflammatory condition produced in that tissue by the irritation from this carious cavity. Some of this may be due to the organisms, but I think that, instead of being caused by organisms, the organisms are there simply because there is decay (disease). I do not believe that organisms necessarily cause the decay of teeth. I do not believe that in the advanced guard or the extreme depth of any decayed tooth or that portion partially decayed, there can be found an organism or anything that looks like one in any possible way. I have never seen it, and I have examined some of the specimens that came from Europe.

DR. SUDDUTH: You can never produce a cavity in a tooth with any acid you may use or can use, without destroying the tissues of the mouth. There is no theory that has ever been advocated that will explain the production of the cavity in the dentine except the germ theory of Dr. Miller. The ferment thrown out by the organisms breaks down the basis-substance. Lactic acid is developed by the micro-organisms themselves. That has been determined positively. This lactic acid takes out the lime-salts, and you have left the basis-substance, which is of the same form as the tooth with the enamel off. In order to form the cavity you have to have something else, and that is the digestive ferment which the micro-organisms furnish.

I hold in my hand the *Independent Practitioner* for August, in which Dr. Miller has just published an article with a lithographic plate showing the different colors produced by the micro-organisms in culture solutions. The micro-organisms develop in the semi-decalcified tooth-substance, which can be raised up with an excavator, and which oftentimes exposes the pulp when so lifted. They throw out lactic acid, and that decalcifies the dentine. The micro-organisms are never found in the tubuli in advance of decalcification. Decalcification proceeds first, and then the micro-organisms enter the tissue afterwards. Micro-organisms cannot find lodgment in a sound tooth that stands isolated. They can only cause decay in a tooth in which a congenital pathological condition has left a cavity, or at least poorly calcified tissue. It is only where a pocket is formed that sufficient acid can be formed to start the process. If the tooth has been perfectly developed and normally erupted, it will seldom decay. I have been working in this line for five, six, or seven years. In 1883 I did considerable work, and reported to the Illinois State Society. The result of my work showed that micro-organisms did not penetrate into sound dentine. Dr. Miller stands pre-eminently the king in this line of research, and I for one am willing to accord him due credit for his labors, and I am satisfied that the profession will also when it comes to know more about the subject.

Dr. Abbott: We care very little for kings in this country, no matter whether they reside on the other side or not. We respect them about as much as we respect one of our fairly-respected citizens. In regard to the production of acid by organisms, Miller says lactic; Niles of Boston says it is not lactic but phosphoric acid. Teeth never decay except by first having the lime-salts dissolved out by some acid. Then micro-organisms are present; but mind you, there is something in a tooth besides lime-salts. By this process (the septic theory of caries) that something, no matter how much or how little it is, all vanishes, it is all gone, without the slightest irritation. These micro-organisms must eat it up, but how is this possible without producing an irritation of living tissue? What are the facts? Take this leathery decay that has been spoken of, make sections of it and put it under a microscope, and you find it full of organisms. You take out a layer that is a little harder, and you find that it has lost considerable of its lime-salts and the organisms are less in number. You take another layer a little deeper into the tooth, and you will find more lime-salts and fewer organisms. You go still further into the cavity, still within the bounds of disintegrated

dentine, and you find nearly the normal amount of lime-salts and no organisms. A layer of the affected dentine still deeper gives the normal amount of lime-salts and not a trace of micro-organisms. The tooth has been affected by something much deeper than the microbes have gone: that something may be the irritation caused by them, or it may be something else. Whether micro-organisms are to blame for this acid condition that is spoken of is of very little account, so far as we are concerned practically. I will venture to say that if anyone of you will keep your teeth perfectly clean, whether they stand tight together or isolated, they will not decay. Keep the food off of them entirely, and you will have no carious teeth. You will have organisms around and upon them, but they will never cause them to decay. Anywhere you please you can find them: in the air you breathe, in the food you eat, and in the water you drink; still they do not destroy us entirely, simply because the conditions are not favorable to their development. They are favorable to the development in all diseases of the throat and lungs, kidneys, and other organs. In all such cases the conditions are favorable for their growth and increase. They are there in consequence of the trouble. They flourish and thrive in a debilitated organism and in disease simply because their life-power is greater than that of the individual.

DR. SUDDUTH: How do you get your cavity in the dentine?

DR. ABBOTT: Sometimes I make it.

DR. SUDDUTH: In ordinary caries?

DR. ABBOTT: I presume that almost every gentleman present has been over that ground a great many times. It is produced in this way: I admit that no cavity in any tooth can be produced without some acid first acting upon the enamel; whether it be due to the presence of organisms or not, it makes no difference. Fermentation of food produces it: this goes on in the depressions of the teeth, and the acid which is produced by that fermentation dissolves out the lime-salts of the enamel. It takes but a little while in some cases, in others a very long time, for it to work through the enamel, but it will eventually "get there." When it gets through the enamel it comes to the dentine endowed with more or less living matter. This becomes irritated, and by and through this irritation, as I have remarked before, the lime-salts are displaced. There is a melting down, through the inflammatory process, of the organic tissues of the tooth. As the lime-salts are displaced by the inflammatory process, the acid comes along and dissolves them and they are taken away. The irritation in this living tissue goes on deeper into the

tooth than any organisms go,—much further than the tooth is broken down sufficiently to demand its removal for filling.

DR. SUDDUTH: I would like to ask how the tissue is taken away.

DR. ABBOTT: It is taken away the same as any other dead tissue is taken away, by a process of decomposition, and that process of decomposition is always marked by the presence of organisms.

DR. SUDDUTH: It has been positively proved that decomposition will not break down tooth-substance. It is only those forms of micro-organisms which produce digestive ferments that can produce the cavity.

DR. ALLPORT, of Chicago: I want to state a fact, and then ask a question.

It will be remembered that a few years ago Dr. Bödecker, in order to demonstrate the effect that arsenious acid had upon tooth-structure, drilled a cavity into a living tooth, and placed in it a small quantity of arsenious and carbolic acids, and then sealed up the cavity. From a slide made from this tooth it was found that there had been produced an enlargement of the tubules of the dentine clear through to the pulp, similar to that which is always found in partially decalcified dentine resulting from what is known as dental caries.

If the destruction of the lime-salts of dentine, and the enlargement of the tubules, cannot be accounted for, as some pathologists claim, without the presence of micro-organisms, how could the condition here mentioned have been brought about? The cavity being sealed, microbes could not have entered unless it was before the arsenic was put in. Had they done so, they could not have lived in the presence of these powerful drugs.

From this I think it but fair to infer or conclude that micro-organisms are not always essential to the dissolving out of lime-salts of a tooth, and that the retrograde metamorphosis of decay may be, as Dr. Abbott claims, to a certain extent, at least, largely accounted for by the process of inflammation.

SECTION V.

MATERIA MEDICA AND THERAPEUTICS.

Chairmen of Joint Committee, JOHN C. STOREY, of the Southern Dental Association, and A. W. HARLAN, of the American Dental Association.

Report of a Case of Cocaine Poisoning.

ABSTRACT OF PAPER BY JOHN C. STOREY, OF THE SOUTHERN DENTAL ASSOCIATION.

IN this case as reported to the writer of the paper, the dentist in charge had made several unsuccessful attempts to extract the right second inferior molar, having broken the crown off across the pulp-chamber just below the free edge of the gum. To alleviate the pain cocaine hydrate 7 grains, chloral hydrate 5 grains, carbolic acid 2 minims, and soft water 2 drachms, was used as a local anesthetic, the gums being moistened freely with the combination. Three applications were made and three swallows of brandy were taken in about five minutes. At the seventh trial with the forceps the patient felt a peculiar stiffening sensation of the joints of the fingers, which extended rapidly to the elbows and shoulders, and on arising from the chair he fell insensible to the floor, remaining unconscious about five hours. Consciousness was regained about eleven o'clock P.M., "the remainder of that awful night" being passed, in the words of the patient, "in a manner which I shall never be able to describe." In the beginning several physicians were called and various antidotes were administered,—tartar emetic, mustard, hot salty water, and coffee. At six o'clock the next morning the patient's arms from elbows to wrists were almost a solid mass of pimples containing pure pus. At the end of three days these turned into little boils, which continued for about five days longer. Patient afterward reported no unfavorable constitutional effects.

SECTION V.—Continued.

On the Hypodermic Use of Muriate of Cocaine in Oral and Dental Surgery.

(Results of more than two hundred injections.)

VOLUNTARY PAPER BY ARTHUR C. HUGENSCHMIDT, PARIS, FRANCE.

IN this communication the hypodermic use of cocaine only will be considered, as it is not my intention to describe the different ways in which cocaine is or has been used in dental surgery. This drug has been employed hypodermically for some time by many practitioners. Experiments with the pure drug or in combination with carbolic acid were made long ago.

My attention was first attracted to the hypodermic use of cocaine in our specialty while listening to the excellent lectures delivered by Prof. Horatio C. Wood at the University of Pennsylvania, in the early part of 1885, when he recommended the method to produce local anesthesia in minor surgical operations, as the opening of abscesses, felons, etc. Some months later, having a portion of necrosed bone to remove from the outer alveolar portion of the superior maxilla, I injected cocaine, and the operation was performed painlessly. I then tried the method for the extraction of teeth or roots, but at first had unsatisfactory results, due, I think, to the bad quality of the drug used. I now use this method nearly if not every day, and sometimes several times a day; but since passing my one hundred and fiftieth operation I have ceased to keep a record, having satisfactory results in all cases. A number of my injections have been made under the direction of my excellent preceptor, Dr. Thomas W. Evans, who has also used this method, and whose severe yet just criticisms have prevented me from using the agent more extensively.

In this connection, the following interesting fact may be mentioned. As Sir Morell Mackenzie, in an official report of the history

of the illness of the Crown Prince of Germany, has spoken of Dr. Thomas W. Evans's connection with the case, it is not a breach of professional confidence to state here that Dr. Evans, who has been attending the Crown Prince of Germany for many years, on one of his visits to the imperial patient last September, at Toblach, extracted a very badly diseased left lower second molar, scraped the socket of the extracted tooth, and made an exploration of the surrounding parts which communicated with the socket by fistulous tracts, all in an absolutely painless manner, a previous injection of one-half grain of cocaine having been made. I may further say that Dr. Evans has always thought and still considers this very seriously affected tooth to have been one of the primary causes of the Emperor Frederick's disease.

Since I have been using cocaine, I have had in all but one local and three general accidents, though five persons felt slightly unpleasant effects of the drugs. These accidents we shall study farther on.

In oral surgical operations I have used cocaine on several occasions with complete success, the following being examples:

A young lady, aged twenty-two, suffered from a very severe and painful nervous affection, the origin of which was ascribed to a non-erupted right upper wisdom-tooth. The gum showed no signs of its presence; still it was decided to make an exploration of the parts in that region, to see if we could ascertain the whereabouts of the missing tooth deeper down. Half a grain of cocaine in solution was injected, half of it outside the alveolar border, the other half in the interior or palatal region. Seven minutes later I made the first incision; the bone was exposed and sounded in two or three places, but no tooth could be discovered. The operation lasted ten minutes, and was absolutely painless.

In another case, where I had to remove an epulis the size of a hazel-nut, cocaine was injected into the surrounding parts, the little tumor was then removed, and the point of attachment cauterized with the red-hot iron, all painlessly. I have used it in cases of re-implantation of teeth, making the operation absolutely painless. On several occasions I have tried these injections in acute periosteal inflammations due to dead teeth, extension from an acute pulpitis or from external causes, but have had very unsatisfactory results. In fact, I had given up the further use of this remedy in this condition, resorting to the usual treatment, when I tried the combined use of antipyrine and cocaine, which gave me excellent results; and now, whenever I have to deal with a periosteal inflammation which will

not yield rapidly to our usual remedies, I first inject seven minims of a five per cent. solution of cocaine muriate in the painful region, to anesthetize the part, for the antipyrine injection is a very painful one. Five minutes after the cocaine is injected I introduce, always hypodermically, fifteen grains of antipyrine dissolved in fifteen minims of water; the pain will usually disappear within three-quarters of an hour. One hour after the injection I give fifteen grains of antipyrine internally. The only trouble from this injection is an induration and slight swelling of the injected part, which will last for a few days but is painless in itself. The cocaine muriate is the salt used. I always prepare the hypodermic solution myself, making it nearly every day, which enables me to have a perfectly fresh solution, which is very important. To do this conveniently, I prepare at one time several small packages, each containing one grain of the salt; when I want to make the solution, with the hypodermic syringe I measure twenty minims of distilled water in a little glass, and dissolve one of the one-grain packages in it. Half the quantity, or ten minims, equal to one-half grain of the salt, is the quantity required for an adult. Many practitioners still inject a whole grain of cocaine. This course is not to be approved, for half the quantity properly used will give exactly the same anesthetic results, and the risk of general accidents is much less.

In June, 1886, I gave at the same sitting, in half an hour's time, to a young man who desired to have eight roots of teeth taken out, one grain and a half of cocaine salt, without any unpleasant effects whatever. I would not advise such a quantity, nor would I again give it, for during the past year there have been several serious cases of accidents reported before the French Medical Society, when one grain of the drug only had been used.

The following is the *modus operandi:* Previous to inserting the hypodermic needle, strict antiseptic precautions must be taken, to prevent local accidents. I oblige every one of my patients to rinse his mouth with a solution of permanganate of potash, then I pass over the part to be punctured a piece of cotton dipped in a bichloride solution (1 to 1000). Then I take into the hypodermic syringe ten minims of the solution, containing a half-grain of cocaine, insert the needle on the outside of the gum, midway between the neck of the tooth and approximately the apex of the same. The needle is held very obliquely, to prevent it as much as possible from sliding on the bone, and is pushed *upwards* for a short distance, in the upper jaw, and downwards in the lower jaw, to the depth of half an inch. Then

introduce five minims of the solution very slowly. The liquid ought to pass out in a comparatively easy manner, if the needle is well inserted. The other five minims are injected in the palatal region again midway between neck and apex of root, using the same precautions as regards sliding on bone. These two injections are to be made, one immediately after the other. If you desire to extract two or three roots which are close together, surround these roots by four injections of two or two and a half minims of solution each.

The local anesthetic action of the drug is almost immediate, but it becomes much more complete if one waits five to ten minutes. While injecting, especially if the needle is introduced in resistant tissues, one can observe in a variable zone, having for its center the point of injection, a bleaching of the gum, which becomes very white and hard; this appearance, however, is only temporary, and at the time of operating will have entirely passed away.

In the great majority of cases the only pain produced is that caused by the introduction of the needle; in one case only was a very severe pain felt, which lasted more than two hours. It is true that this patient was suffering from an acute periosteal inflammation, and in such cases, as I said before, the local anesthetic effect is much less marked, almost absent.

The local action of the drug is probably twofold; its immediate effect being an anemia of the injected part, probably due to a stimulating action on the vaso-constrictor of the peripheral vessels. The local anesthetic effect is due, as stated by Laffont and Arloing, to an inhibitory action on the peripheral sensitive nerves. In fact, Laffont calls cocaine "sensitive curare," and according to him it acts on the termination of the sensitive nerves as curare does on the peripheral motor plates. Brown-Séquard has drawn attention to the fact that sensibility to pain alone disappears, while tactile sensation remains, with all agents which act on the peripheral nervous system. This is the case with cocaine, and I have noticed, whenever I have given the drug in injection, that afterwards the patient will report himself to have felt nearly every step of the operation, but without any pain whatever. Cocaine is, then, a local anesthetic to pain only, and not to tactile impressions,—a true local anesthetic.

Brown-Séquard has also demonstrated the fact lately, that when cocaine is injected directly into a vein, a general anesthesia, similar to that following the administration of chloroform or ether, will be produced,—an insensibility to both painful and tactile impressions.

The local accidents produced by cocaine have been more or less

extensive sloughing of the soft parts surrounding the point of injection, followed in some cases by a local necrosis of the denuded portion of the bone. The only local accident I have had was a slough and necrosis of a piece of alveolus about the size of a pea, opposite an upper wisdom-tooth. This accident I attribute entirely to carelessness on my part. The tooth was very badly situated, and in addition the muscles of the cheek were very strong and powerful. I forgot all about antiseptic precautions, whereas we know that the back part of the mouth is especially exposed to the action of septic agents. Moreover, I had great trouble in introducing the hypodermic needle, in fact broke two, and when at last I succeeded in introducing it I thought I would inject anyhow, though I had to use great force to drive the liquid out, which indicated that the needle was in contact with bone. Two days afterward a small slough appeared, and six weeks later a small piece of bone came away.

The sloughing of the soft parts which has been reported I attribute in great part to lack of antiseptic precautions; but as regards the necrosis of the bone, it is certainly due, in the great majority of cases, to injecting the liquid when the needle is too near or even directly in contact with the bone; the force of the injection producing a local periosteal detachment and a necrosis of the part of the bone thus exposed. To avoid this, whenever I feel that the needle has struck bone I withdraw the syringe somewhat before I make the injection.

Let us now examine the effects of cocaine on the general system.

When one-half grain of cocaine muriate is injected, in the very great majority of cases, no unpleasant symptoms will present themselves, and if the person is in a perfectly normal state, not fearing the operation, no physiological action of the drug will be noticeable. If, however, one has to deal with a frightened person, he must be extremely careful, and I should even advise never to inject cocaine into a person who shows the least fear. Postpone your operation, and try to convince the patient that the injection can be made without danger. If you do inject when the patient is frightened, you will certainly produce a *partial* unconsciousness, which is one of the particular effects of cocaine. This partial unconsciousness has supervened in all persons who were frightened when I operated on them. The explanation for such relation between fear and the apparently increased physiological action of the drug on such persons, we shall consider after having examined the physiological effects of cocaine.

I have observed the following in three patients of mine who presented general symptoms. Two of the cases occurred in my early practice, when I used one grain of cocaine salt, the last one with the exhibition of one-third grain in a very anemic patient.

About one minute after the injection the patient complains of a strange feeling in the head, then becomes pale, and with the increase of the pallor he complains of cold all over (my first case had formication in the extremities). The pulse rises to 110–130, respiration slows and becomes embarrassed, even gasping. Never have I seen a complete unconsciousness, as is proved by the fact that I make it a rule to talk continuously to my patients when they get in that faint condition, to prevent them from getting drowsy; a point which I think ought not to be overlooked. This only partial unconsciousness produces in the patient the awful sensation of fear of approaching death. In a case which was reported lately by Dr. Dejerine, the patient had taken fifteen grains of cocaine hypodermically at one time, and remained apparently unconscious for half an hour, but he afterwards assured the physician that he felt him when he pinched his hands. Consciousness is therefore not entirely lost to the patient, although it seems so to those about him.

The pallor of the face and the sensation of extreme coldness in the extremities indicate certainly a general vaso-motor disturbance. Cocaine seems also to influence very materially the circulation as well as the respiration, which is probably due to a great disturbance of the cerebral circulation at the base of the brain, resulting in cerebral anemia. Laffont has indicated that it had a very exciting action on the vaso-constrictor filaments of the great sympathetic nervous system.

Let us now examine the condition of a frightened person. One of the first apparent symptoms is pallor of the face, which certainly indicates a vaso-motor disturbance of this region, of its peripheral circulation. If the fright is kept up long enough, the patient will also feel cold, and soon a sensation of fainting will present itself, which may go on to *absolute* unconsciousness. Here, again, we have a great disturbance of the cerebral circulation, constriction of the vessels producing anemia of the brain, as shown by the symptoms.

Now, if to such a patient, already frightened, whose peripheral and cerebral circulation is already interfered with, you administer an agent, cocaine, which produces the same train of symptoms, you will certainly have an apparently increased physiological action of the drug, and you must be prepared to meet with the usual accidents,

—partial unconsciousness, very rapid pulse, slowed and labored respiration, cold extremities, etc.

The influence on the patient of a previous knowledge of the accidents which may be produced by cocaine is really remarkable. The following case will prove to be interesting in this relation: A lady desiring to have a tooth extracted with cocaine, I was called to make the injection. This patient had been told beforehand by her physician what unpleasant symptoms presented themselves in certain cases of cocaine injections. The description given was an inaccurate one. The patient being very frightened, I insisted on postponing the operation, but not succeeding in doing so, I announced that I was going to inject the salt, and then introduced in the gums ten minims of *distilled water*. In less than half a minute she complained of a terrible sensation in her head, and soon cried out, "I am dying." She *fainted*, but was not in that semi-unconscious state which characterizes cocaine disturbances. Her physician had forgotten to describe to her this particular cocaine faint feeling. This was a case of self-hypnotization, no doubt.

The only case of accident, in my experience, which cannot be attributed to fear occurred a few days ago. The patient was a young married lady, aged twenty-three, apparently in perfect health, very courageous, on whom a slight cutting operation in the back part of the mouth was necessary. I injected only one-third of a grain, the operation being a very superficial one. In less than one minute she complained of a strange feeling in her head, when she was immediately placed on her back. The pulse ran up to 120 and the respiration slowed, but, as usual, there was no loss of consciousness. I gave her five drops of nitrite of amyl to inhale, which made her feel better. Then I gave her a hot brandy punch, to which were added forty drops of sulphuric ether. This restored her rapidly. She then told me that she was extremely anemic, which neither her face nor lips indicated. She had traveled for nearly six months in India, where she contracted fever, and in addition, five months previous to my seeing her, she had had a miscarriage, which obliged her to remain for three months in bed.

Anemia is, then, a contraindication to the use of cocaine.

I have used this drug with great caution, not giving more than one-third of a grain in obese persons, in whom the state of the circulation is always doubtful. The same precautions should be taken in the case of old people, in whom there is a tendency to an atheromatous condition of the blood-vessels.

Hysterical patients are also to be carefully managed, or you are liable to bring on an hysteric attack. The following case will exemplify. For a woman, aged thirty, who presented unmistakable signs of hysteria, and especially the well-known "globus hystericus" and cerebral nail, "clavus hystericus," among them, I injected, in my earlier use of the drug, one grain of cocaine. The first symptoms produced were an increase of the cerebral nail feeling, or sensation of strong pressure applied to the top of the head; next, a feeling of extreme pain in the gastric region was manifested, and finally she fell in the characteristic semi-unconscious state. She was placed in a recumbent position for three-quarters of an hour and kept quiet, nothing being given her, after which time she felt perfectly well.

In cases of cardiac and pulmonary diseases I am always specially careful, never giving more than one-third of a grain.

The third case of general accident I have had is the following: Patient a young man aged twenty-five, with a facial clonic convulsive tic which it was thought was due to a solitary tooth which was regarded as the point of origin of the reflex. I injected three-fourths of a grain of cocaine. In about a minute and a half the ordinary symptoms presented (pallor of face, semi-unconsciousness, very rapid pulse, irregular respiration). The object of the injection was to suppress the point of origin of the reflex, and in that manner do away with the spasm temporarily. The clonic spasms persisted, however, while the parts were under the anesthetic influence of the agent, and I concluded that the suspected tooth had nothing to do with the case. This tooth was sacrificed later. On examination its roots were found to be exostosed, but the tic remained the same.

In persons suffering from advanced constitutional diseases, such as the last stages of tuberculosis, diabetes, or the cachexiæ of different diseases, I have always refused to administer the drug. A fact worth mentioning is the apparent innocuity of cocaine in plethoric subjects, in whom the cerebral circulation is certainly very active. Having had the opportunity of making a few injections on several such persons, two of them being indeed very much frightened, I must say that not one, at any time, experienced one of the cocaine symptoms, and all reported that they felt perfectly well and comfortable. As cocaine seems to have such a decided action in rapidly lessening the cerebral circulation, would it not be advisable to try the hypodermic use of this remedy in cases of cerebral hemorrhage or apoplexy, or in sunstroke?

The combination of carbolic acid and cocaine, which has been recommended for some time, I have never used, being perfectly satisfied with the results from the pure drug. Moreover, I did not see the advantage of bringing together these two drugs, whose local anesthetic effect is produced in entirely different methods. We know that cocaine acts on the peripheral sensitive nerves in such a way as to render the part insensible to pain but not to sensation, allowing patients to follow every step of the operation. Therefore it does not destroy the sensitive nerve extremities. Carbolic acid, on the other hand, is a coagulant local anesthetic, producing insensibility by coagulation of the albuminous constituents of the histological elements of the parts with which it comes in contact, and therefore destroying definitively their physiological functions.

As to the treatment of the unpleasant symptoms, as soon as a patient feels faint I place him immediately in the recumbent position, and, as I said before, I keep on talking to him to prevent drowsiness. Smelling-salts may also be used. If the patient remains pale, with pulse rapid and embarrassed respiration, place five drops of nitrite of amyl on a handkerchief and direct him to inhale it until he feels better. Ten minutes later another five drops may be ordered if necessary.

In the case of the accident with the anemic patient, I gave in a brandy punch forty drops of ether, with an almost immediate result.

Finally, in case of very severe poisoning, if several grains of cocaine have been taken, two or three hypodermic injections of thirty drops of ether can be given, which will certainly act favorably on the disturbed circulation.

ADDENDUM.

Up to this date (July, 1888), the number of my hypodermic injections has passed four hundred cases. Since the foregoing article was written I have had but one case presenting slight general symptoms, which lasted only a few minutes, nitrite of amyl inhalations being used with excellent results.

I find that I omitted mentioning in my article the following fact, which is important if one desires to extract roots of teeth in an *absolutely* painless manner. When the parts surrounding the root to be extracted have been anesthetized by a cocaine injection, the forceps beaks are to be gently pushed into position, and the extracting movements made very slowly, without trying to extract a root by one single twitch or pressure. The rapid method of extracting

must be avoided, and this is easily done, as the patient will feel no pain at all if the parts are not roughly handled.

I have used these injections in six cases of implantation of teeth (Younger's operation). In five cases I have only given one-half grain of muriate of cocaine in ten minims of water; five minims of this solution being injected outside, and five minims inside of the masticating line. This quantity was quite enough to enable me to make the operation in a perfectly painless manner. In one case I had to give an additional injection, as sensibility returned very rapidly.

When excavating in excessively sensitive teeth, I occasionally have recourse to the hypodermic injection of one-third grain of the drug, as near as possible to the end of the root, with good results.

SECTION V.—Continued.

Dental Materia Medica and Therapeutics.

PAPER BY L. G. NOEL, OF THE SOUTHERN DENTAL ASSOCIATION.

IT is not our purpose to write a treatise on Dental Materia Medica, but in compliance with the request implied by our appointment on this committee, we shall endeavor to mention briefly a few of our most valued therapeutic agents, together with such reasons for employing them as may be adduced from our observation and the experience of other reputable practitioners.

When a student of medicine, eighteen years ago, at the University of Nashville, the venerable Dr. W. K. Bowling (a worthy son of this proud old State of Kentucky) occupied the chair of "Theory and Practice." How often have we heard him warn his students against "an overweening confidence in drugs." He urged the most extended research and experimentation, but warned us to rely only upon those things that have been tried and proved. We recall the experiences he related, the anecdotes and incidents culled from his years of practice, to show how he left the halls of his alma-mater believing in the efficacy of all the so-called remedies of the pharmacopœia, and how he recounted the long series of disappointments running through years of practice, until he had reduced his stock of drugs to "a few simples," "a dozen or more of things well tested that could be relied upon under certain circumstances to produce certain results."

This teaching was valuable, and the lasting impression it made upon us saved us much of the disappointment we else had met in practice. Thus we find in dental practice we need few remedies; but let us not be mere routinists, persistently refusing to try new things. Let us progress!

What do we need first in most dental operations? Pain-obtundents—local anesthetics. We shall notice these first. The following

list comprises the most important agents used for this purpose: Chromic acid, chloride of zinc, cocaine, iodoform, menthol, aconite, veratrina, and the refrigerants.

The two first-mentioned articles have not been extensively employed for this purpose, and are not likely to be, on account of their irritating action on the dental pulp; therefore we shall pass them without further remark.

The refrigerants, sulphuric ether and *rhigolene*, as applied by the atomizer, are very useful obtundents, but many patients object to the first shock of pain attending their application as producing that which we are seeking to overcome. Dr. B. W. Richardson was the originator of this practice in 1866. He employed pure sulphuric ether and obtained the frigorific results by the use of an atomizer, which took his name. We do not know who first introduced it into dental practice, but it soon became a favorite local anesthetic for extracting teeth, and was used to some extent for obtunding sensitive dentine as far back as 1870. Prof. Henry J. Bigelow introduced rhigolene as a substitute for ether, claiming, on account of its greater volatility, to obtain a lower temperature with it than could be produced with ether. This agent is rarely kept by druggists, and besides the difficulty of obtaining it, the results have not been so satisfactory with rhigolene as those obtained from ether. In the extraction of roots the pain is thus greatly reduced. It is especially applicable to roots situated in the superior maxillæ. It seems to induce an excessive flow of saliva, and in the lower jaw this soon overflows the parts to be operated upon, necessitating frequent pauses for voiding the accumulated fluids, hindering the freezing process; however, some anesthetic effect may be produced by the ether vapor inhaled by the patient.

Veratrina is an alkaloid obtained from veratrum sabadilla. Dr. E. A. Bogue, of New York, has used it with good results as an obtundent for sensitive dentine. He gives the following formula:

℞ Veratrina, gr. iv;
Tannic acid, gr. j;
Alcohol, gtt. xx;
Glycerin, ʒj;
Carbolic acid, ʒij. M.

Thoroughly dry the tooth and apply to the sensitive surface.

Aconite has been found more useful for its analgesic effects in cases of pulp-exposure and inflammation of the peridental membrane.

Menthol has been advocated for sensitive dentine, but is of more value as a remedy for neuralgia in conjunction with the oil of cloves or cajuput. Thus:

℞ Menthol, gr. v;
Oil of cloves (or oil of cajuput), ʒj.

Cocaine seems to be the best result of our pharmaceutic research in this direction to day, but it has, like most new remedies, been so enthusiastically heralded by many prominent gentlemen in the profession, who have made such positive assertions of its absolute dominion over the sentient nerves of the parts to which it is applied, that its use has been attended by much disappointment to the rank and file of practitioners. These enthusiastic cocainists seem to have become more sparing of their praise and more careful of their statements of late. We see less of their laudation of cocaine now in the journals and newspapers. Notwithstanding all this, cocaine is a useful addition to our materia medica. The trouble is not with cocaine, but with our riotous fancies.

Much work remains to be done in this direction. The ideal obtundent, like the ideal filling, is but a dream of the future. The hydrochlorate of cocaine is the preparation most used. This is freely soluble in alcohol, water, and ether, some operators preferring one menstruum and some another.

Dr. Gordon White uses a saturated solution of cocaine hydrochlorate in ether, and thinks this the best preparation of cocaine for sensitive dentine, or for pulp-extirpation. We have experimented with it at his suggestion, and find it very efficient. This is a modification of Herbst's obtundent, but as the simple ethereal solution cannot be so quickly obtained, requiring time and trituration, the Herbst combination is a key to the difficulty, and a stronger preparation, especially since it embraces another agent having valuable obtundent powers,—*i.e.*, sulphuric acid.

To make Herbst's obtundent, first get a saturated solution of cocaine hydrochlorate in chemically pure sulphuric acid, and add sulphuric ether to the point of saturation, allowing the excess of ether to escape by evaporation. Our experiments upon sensitive dentine with Herbst's obtundent have been more successful than with any other cocaine preparation we have used.

We attribute its efficacy to the combination of two or more local anesthetics in one solution. Sulphuric acid, when applied to living tissues possessing as low vitality as dentine, destroys all life as far as

it penetrates, and by its chemical union with the lime-salts of the dentine breaks down the structure sufficiently to furnish the cocaine free access to the peripheral extremities of the nerve-fibers. Whether the ether plays any important part we do not know, but it is a convenient vehicle for the other ingredients. Wherever this solution touches the enamel, effervescence occurs, showing the destructive nature of the sulphuric acid; therefore, great care must be taken to protect the enamel from its contact.

We do not know whether or not its action upon the dentine will go far enough after the insertion of the filling to produce deleterious effects, our experiments having been too recent to furnish the necessary observations, but we feel sufficiently uneasy on this point to use great caution. In one instance we tried it as a local anesthetic for the gums where a wedge had to be driven high against the festoon. It whitens the gum immediately upon contact, giving it the appearance of having been frozen with ether spray, at the same time destroying sensibility to pain very effectually. The difficulty of applying it to the gum without allowing contact with the enamel nearly precludes its use here.

Creasote and *carbolic acid* are agents so nearly allied to each other in their properties and uses that they may be noticed under one heading. Indeed, the effects and uses of the two are so nearly the same that one may be often substituted for the other with equally good results.

These remedies are perhaps our most efficacious medicaments for that form of odontalgia arising from exposure and inflammation of the pulp. We give our preference to pure wood creasote, and think we have had better success with it than with carbolic acid. When these agents are applied to the pulp in full strength, a thin film of coagulated albumen is formed upon the surface that, by some, is thought to be a protection from further irritation. Others think death and gangrene of the organ may result from full-strength applications, and claim that better results may be had with solutions.

This is an open question, but we unhesitatingly give our preference to the undiluted drug. Both creasote and carbolic acid are freely soluble in alcohol, ether, and chloroform. Carbolic acid dissolves readily in water, but creasote is only slightly soluble in water. Solutions of these agents are found valuable as deodorizers, germicides, and reactive stimulants, and have been much used in the treatment of alveolar abscess, diseases of the antrum, purulent inflammation of the gums, alveolar pyorrhea, etc. Dr. J. S. King,

of Pittsburg, has had the best results in pulp-capping with a paste composed of white oxide of zinc and creasote in full strength. This he applies directly to the exposed organ, then over that a covering of oxychloride of zinc. We have found this application very soothing to the pulp, but we now prefer the oxyphosphate as a foundation for the filling.

Arsenic.—Some claim to be able to practice dentistry successfully without this valuable agent, but until local anesthetics of greater power are discovered we should not like to banish it from our medicine-chest. The violent pain that it produces in the first stages of its action, lasting, as it often does, two or three hours, may be almost entirely prevented by a combination with other drugs. Dr. E. C. Kirk has suggested a nerve paste composed of arsenic and cocaine hydrochlorate, and gives the following formula:

℞ Arsenious acid in fine powder,
Cocaine hydrochlorate, *āā* gr. xx;
Menthol crystals, gr. v;
Glycerin enough to make a stiff paste.

We have found this a very valuable prescription, but think we have improved upon Dr. Kirk's formula by the substitution of sulphate of morphia for menthol, and creasote for glycerin. This is practically but an addition of cocaine hydrochlorate to the old formula, thus:

℞ Arsenic in fine powder,
Cocaine hydrochlorate, *āā* gr. xx;
Morphia sulph., gr. x;
Creasote, q. s. to make a stiff paste.

This trio of sedatives in combination with arsenic operate more magically in our hands than any other nerve paste we have ever used. They serve to anesthetize the pulp until the congestion induced by the arsenic has progressed far enough to cut off all sentient connection.

Antiseptics.—Heat is one of the most valuable of all antiseptic agents. As applied to dental practice, you have only to recall the remarks of Dr. Allport at the last meeting of the Southern Dental Association, and the little instrument he exhibited for applying heat to the canals of pulpless teeth. This is a smooth nerve-canal broach with a bulb upon the shaft that may be heated in a spirit lamp, furnishing a reservoir of heat, such as a light steel broach could not otherwise retain. It is a most valuable instrument, and

with its aid the dentist may burn out much of the organic matter from pulp-canals before using other antiseptic agents.

We cannot undertake in a short paper like this to speak of all these drugs. The following list includes the best: Chlorine, zinc chloride, calcium chloride, iodine, bromine, salicylic acid, oil of cloves, oil of thyme, oil of eucalyptol, carbolic acid, creasote, resorcin, boric acid, naphthalene, naphthol, hydronaphthol, iodoform, iodol, hydrogen dioxide, and mercuric chloride. In the antiseptic treatment of pulpless teeth, the mercuric chloride is the agent with which we wish always to begin our treatment.

Dr. Bronson, of New York, was near the truth when he advised dipping the drill with which the pulp-chamber is opened into a solution of corrosive sublimate. What we prefer, after as thorough washing with the syringe as possible, is to wipe out the canals with a solution of the mercuric chloride of the strength of from one grain to one and one-quarter grains to the ounce of water. This will entirely destroy all surface micro-organisms, and if the teeth have not become sore will prevent inflammation of the pericementum, and possibly alveolar abscess. As it is difficult to preserve for office use a solution of mercuric chloride, owing to its proneness to undergo chemical changes when suspended in water, some method of quickly preparing a solution for each case as it comes up will be found necessary in order to obtain the best results. The salt dissolves readily in water containing a solution of chloride of ammonium. Thus by keeping at hand powders containing—

Mercuric chloride,
Ammonium chloride, āā gr. j,

a solution may be readily prepared by adding one of these powders to an ounce of distilled water.

Another method is to take of corrosive sublimate and hydrochloric acid each one drachm, distilled water enough to make one ounce. This forms a perfect and permanent solution. One teaspoonful of this to a pint of water makes a solution of 1 to 1000. (*Southern Cal. Practitioner.*)

This is strong enough to use as a sterilizing fluid in general surgery, and an excellent preparation for washing out the pus-sacs of alveolar abscesses, the antrum, or the pus-pockets about teeth affected with pyorrhea alveolaris.

Iodine is one of the most valuable disinfectants and germicides in the list, and in the treatment of alveolar abscess we have found the

compound tincture, injected full strength through the pus-tract, often work a complete cure after one application. The use of this preparation of iodine for alveolar abscess was suggested to us by Dr. Richard Cheatham, of Nashville, and the results have been in many cases almost like magic.

We have come to prefer the compound to the simple tincture for cleaning and disinfecting root-canals. It is less irritating. We have found it a valuable application to the pus-pockets about teeth affected with alveolar pyorrhea.

Iodoform is a valuable germicide and disinfectant, but its unpleasant odor is very difficult to disguise.

Dr. Peirce, of Philadelphia, uses iodoform as a canal-dressing after the following formula:

℞ Iodoform,
Oil of cloves,
Oil of eucalyptol, *āā* ʒ vj.

This disguises the odor very effectually, and is a dressing that may be used with good results. It has been esteemed very beneficial in the treatment of pyorrhea alveolaris.

Dr. E. C. Kirk makes a paste of iodoform with cinnamon oil, thus disguising its offensive odor.

Iodol—tetraiodopyrrol—C_4HNI_4, has but lately been brought into notice as an efficient germicide without toxic properties, and while closely allied to iodoform, is free from its objectionable odor. It is nearly insoluble in water, but very soluble in absolute alcohol, ether, chloroform, and carbolic acid. It contains ninety per cent. of iodine.

Hydronaphthol.—This is a derivative of the hydrocarbon naphthalene. It appears in light fawn colored crystalline flakes, having a slight odor and taste. Dr. Leffmann says,* "It does not appear to have the power to destroy already existing germs or their spores, but to possess merely an inhibitory action upon their development." Dr. James Truman, at the last meeting of the Pennsylvania State Dental Society, spoke highly of its efficacy as an ingredient for a mouth-wash to be used in any case of diseased gums, whether caused by an uncleanly, ill-fitting plate or accumulations of tartar about the teeth.

Hydrogen dioxide—peroxide of hydrogen—H_2O_2, is obtained from the decomposition of barium dioxide by sulphuric acid in the presence of water. In the pure and concentrated form, hydrogen

* American System of Dentistry.

dioxide is a syrupy liquid, easily decomposed and decidedly caustic. It is soluble both in ether and water. We do not know to whom belongs the honor of introducing this valuable agent into dental practice, but the writer of this paper was first led to try it after reading a paper by Prof. A. W. Harlan, of Chicago, strongly indorsing it as a remedy for alveolar pyorrhea. Subsequent experiments of our own have fully confirmed many of the statements he has made of its power to eliminate and check the formation of pus. We cannot better illustrate its powers than by relating a case it cured for us, when it was taken up as a last resort. A young gentleman of decidedly strumous diathesis applied to us with an abscessed central incisor. The upper lip was much swollen, and he was suffering intensely. The pulp-canal had been filled by a dentist in Alabama several years previous to this, and upon attempting to remove the filling we found it thoroughly closed, to the very apex, with what we took to be oxychloride of zinc.

We at last succeeded in passing through the apex with a Gates drill and let out a quantity of pus. We confidently expected to cure this abscess in a day or so with one injection of Lugol's solution of iodine, as we had often done it in other cases, but one, two, three, four and more injections failed to check the flow of pus. In the meantime the quantity of pus discharged each day was increasing, and the consistence grew less until a fluid was discharged almost as clear as water, and in such quantity as to lead us to suspect that the abscess had penetrated some of the mucous cavities of the face, and that the discharge was principally mucus and nothing more. However this may have been, the swelling did not fully abate nor the discharge diminish, until, in desperation, we concluded to try Harlan's remedy. We injected a strong aqueous solution of hydrogen dioxide from a dental syringe, packing gutta-percha about the pipe to prevent regurgitation, driving it through the opening of the abscess-sinus in the gum over the apex of the root. The improvement was so rapid and so marked that our patient requested us to tell him all about the wonderful drug that had saved his front tooth from the forceps.

Dr. Black has used hydrogen dioxide in combination with mercuric chloride as an injection for alveolar abscess and other treatment requiring antiseptic and germicidal effects. His formula is,—

℞ Hydrogen dioxide, f℥j;
Mercuric chloride, gr. ij.

Zinc Chloride.—This has been used as an obtundent of sensitive

dentine, but is of more value as a disinfectant. It is used with good results upon diseased gums, entering as an important ingredient into mouth-washes. Dr. E. C. Kirk, at the recent meeting of the Pennsylvania Dental Society, extols it as a mouth-wash.

Boric acid possesses valuable antiseptic and germicidal properties, and is now used extensively by aurists in the treatment of purulent inflammation of the ear. Its power to arrest fermentation and putrefaction has been repeatedly demonstrated. It is used in the treatment of aphthous ulcerations of the mouth and fauces, and is of great value in cases of catarrh and follicular laryngitis, rapidly correcting the intense fetor of the breath when properly brought to bear upon the diseased parts. This may be accomplished by the inhalation of the vaporized solution. As a mouth-wash and gargle it is employed in a solution of about twenty grains to the ounce of water.

Alcohol.—This is the most valuable of cleansing agents in the whole dental pharmacopœia. In the treatment of pulpless teeth, any system of disinfection and sterilization that does not contemplate as thorough cleansing of the entire substance and body of the dentine as is practicable, will fall short of the best attainable results. The extraction of the fluid contents of the dentinal tubuli is made possible by the use of alcohol. Its affinity for water enables the dentist to suck out of the dentine by capillary attraction the fluid contents, and vaporize, dissipate, and change them. Dr. Harlan told us his method of doing this some years since, and we need not repeat it here. We have only to suggest one additional idea, *i.e.*, the soaking of this desiccated dentine thoroughly with a solution of mercuric chloride before removing the rubber-dam; thus destroying all germs and spores that may be lodged in the dentine to proliferate and cause after-trouble.

SECTION V.—Continued.

Notes on Guaiacol and other Remedies.

PAPER BY A. W. HARLAN, OF THE AMERICAN DENTAL ASSOCIATION.

DURING the years 1887–88 many new remedies have been proffered for use in dental medicine and surgery, most of them being on trial by dental therapeutists at this time. Included in this list, which is not complete, may be found creolin, sodium fluorsilicate, guaiacol, several coal-tar derivatives, and the active principles of many of the essential oils. The activity in chemical circles is so great that medical literature is burdened with the number of remedies belonging to the antipyretic and the anti-neuralgic classes. Among the latter may be mentioned antipyrin and antifebrin, constitutional remedies of great value in facial neuralgia. The continued study of microbes and the lists of germicides and disinfectants to annihilate them go side by side. No sooner is a new microbe discovered than the therapeutist offers a choice collection of disinfectants, from which selection is to be made for destroying the spores and rendering operations free from septic infection. The tendency of present practice in dental therapeusis is to use such medicaments as are least harmful to normal tissues, but which will afford a certain destruction of the microbes present.

I wish to call your attention for a few moments to guaiacol, a derivative of wood creasote. It is a light straw-colored liquid, pungent to the taste, but less objectionable to smell than its parent. Guaiacol and cresol are both isolated from creasote, and they may be considered the active principles of creasote. Guaiacol is used in internal medicine, but in dental surgery few practitioners have availed themselves of the opportunity of using it. It will combine with all the drugs that creasote will, and being sparingly soluble in water it is

one of the agents which may be used as a permanent disinfectant of root-canals. Combined with the common oil of cassia, it loses what little disagreeable odor it possesses, and we have then united two of the most powerful oily disinfectants now known.

It may not be generally understood that the oil of cassia is a potent restrainer of the growth or development of the bacteria of the human mouth. However, from experiments made under the direction of Prof. G. V. Black, of Jacksonville, Ill., oil of cassia was shown to be the best restrainer of the growth of microbes out of a long list of drugs experimented with. Many drugs tested were found absolutely valueless, and others of feeble power. Wood creasote, oil of cassia, and an acidulated solution of bichloride of mercury were found the most constant and unvarying in their inhibitory power over the microbes of the human mouth. It was from the results of these experiments that I was induced to join guaiacol and oil of cassia and make use of them in the disinfection of foul and putrid roots of teeth.

It cannot be questioned to-day even that the subject of the disinfection of pulpless teeth has a great charm for the faithful experimenter, whose sole desire is to accomplish this object in the most perfect manner. In spite of the vast number of papers read on the subject and the discussions thereon, a wide difference of opinion and practice prevails throughout the civilized world. My only object in recalling your attention to this phase of dental practice is that more light may be thrown on the subject, in order that such teeth may be retained in the mouth for a longer period of time and usefulness and in greater comfort for the possessor. The advanced dental surgeon and hobby-rider is just as apt to ride a hobby as the routine-worker is to be a stumbling-block in the path of progress. But the hobby-rider, from much study, many failures, and unceasing experiment, will in time be able to do more good in practice than the routine-worker, for from all his experiments he is able to formulate a system based on failures as well as successes, avoiding the pitfalls into which the routine-worker is continually stumbling. It is from long experience in this direction that the writer has the temerity to say that a pulpless tooth, after the decomposition of the pulp within it, is in need of disinfection by the use of medicaments in every case, as no amount of cutting short of its total destruction will disinfect it. When a pulpless tooth is to be quickly disinfected, an aqueous solution of a drug must be used; if potent, it should be in weak solution. When slow disinfection is to be accomplished

(many times desirable), an oily disinfectant should be used, one feebly or sparingly soluble in water; the reason for these statements being that in the first case aqueous solutions easily and quickly permeate the contents of the root-canal and dentine, and in the latter case the oils slowly deposit vaporizable camphors, which are potent disinfectants that readily penetrate the infected territory and slowly but certainly disinfect it. At the same time the oils being sparingly miscible in one-half of one per cent. of water, their integrity is unimpaired for long periods of time. I have placed within a pulp-chamber, both foul-smelling and full of débris, a drop or two of guaiacol and oil of cassia, and sealed the cavity of decay with a cotton plug dipped in sandarac, and allowed it to remain for forty, sixty, and seventy days, and on removal the contents were found to be completely disinfected, and the root was filled immediately without causing trouble.

It is on account of the hitherto unsuspected value of the oils in dental surgery that I recall your attention to them, in the hope that they may prove of value in your hands.

DISCUSSION.

DR. GENESE, of Baltimore: The paper of Dr. Noel, while giving us a large number of remedies, called to my mind one or two old-time ones which I think are worth repeating, and one of the later ones which we have all had some experience with. Local application for the relief of pain by ether was long anticipated by the application of cold, by Dr. Walker Blondel, of London, in 1854. The only care that was required was not to press the cooling too far, for fear of coagulation and sloughing. I was present somewhere about 1860 at an operation he performed, and the only thing he used for producing local anesthesia was cold water and salt, and several molar teeth were removed in this way, without any apparent infliction of pain.

Another remedy that I did not hear mentioned, and one that I have found very efficient, is the extract of white poppy. This gives all the sedative action of the opium without its soporific effect. It can be used freely in the oral cavity, and gives almost immediate relief in those acute cases of abscess that start to aching in the night. In the treatment of abscess from the pulp, and where the patient comes in at night, an application of a piece about the size of a pea over the immediate point of inflammation will so

soothe the pain that rest can be obtained. In combination with this another preparation might be used, the sulphite of calcium given internally in a half-grain to a grain dose. This will so hasten suppuration over the point of the seat of the mischief that when the patient presents himself in the morning you have very little difficulty in controlling the whole of the trouble. Another preparation that has not been mentioned in the paper is the tincture of gelsemium. This is an excellent thing for allaying facial neuralgia from congested pulp, and sometimes from the pulp that has already commenced to slough. I would like to hear from other members upon any of these drugs that I have mentioned.

DR. STOREY, of Dallas, Texas: There is one other method of producing insensibility to pain that I would like to mention, and one which I sometimes use. On the battle-field during the late unpleasantness we had many demonstrations of its value. How many men on the battle-field did not know that they were hit with a bullet, while making a charge of a quarter of a mile at a fast run, until the trickling of the blood and their weakness brought them to the ground? I refer to rapid breathing. Try it. You will be able to extract teeth without pain to your patients.

DR. J. S. MARSHALL, of Chicago: I desire to ask Dr. Harlan a question. He makes the statement that guaiacol, mixed with oil of cassia, and left in the tooth from forty to seventy days, completely disinfected the roots. I want to ask the doctor how he demonstrated that they were completely disinfected?

DR. HARLAN, of Chicago: By filling the roots and having no further trouble. That is the only way I could demonstrate it.

DR. PATTERSON, of Kansas City: I hardly think that was the best demonstration, and I want to ask whether it is not possible to determine the shortest length of time which would be required for any of those disinfectants and germicides to thoroughly disinfect and destroy the germs in the pulp-canals. I think that is a very interesting question which has not been touched on, except by Dr. Harlan in speaking of one remedy. The fact that a pulp-canal was closed and no evil result followed would not be a scientific demonstration that all germs had been destroyed, and I think to get at that point would be very useful indeed, as indicating the time to wait before filling pulp-canals in septic conditions.

DR. SUDDUTH, of Philadelphia: Perhaps I can answer the question of Dr. Patterson. It can be done scientifically in the laboratory by taking culture-tubes of gelatine, opening the canal at different times

under thoroughly antiseptic conditions, and passing a broach into them, then withdrawing it and placing it in the tube; you can thus ascertain the exact time when the micro-organisms will no longer develop. Such a method is hardly possible for a dentist in actual practice to pursue, and Dr. Harlan's answer is the most practical one after all.

DR. MARSHALL: That is all right in actual practice, but when a man introduces a new remedy it seems to me the experiment to demonstrate its value should be something more than the plugging of the tooth. If he had followed the method Dr. Sudduth has suggested, we should have some positive evidence of complete disinfection. As it is we have no positive evidence, for he simply gives the results in the one case.

DR. PEABODY, of Louisville: Some years ago I presented to our State Association a paper giving the result of some experiments I had made on the cure of chronic alveolar abscess by filling the root-canals with crude lead. I have written to many scientific men of the country, and have applied to chemists for information as to the cause of this cure, but have received no satisfactory reply. If anyone here can give me an explanation he will confer a great favor.

Some ten years ago, a gentleman applied to me having a chronic abscess over the left lateral incisor tooth. Upon the first treatment, creasote was forced through the fistulous opening, showing that there was a clear track. I went through the whole range of materia medica in my efforts to cure this case, but without success. After eight months I decided to remove the tooth and replant it. The gentleman requested me to wait a few weeks, as he was going out of the city; and as I wished to fill the root in order to keep out food and to give the tooth greater strength in case I had to extract it, I decided to use lead, as being soft and easy to force in, and because it would furnish sufficient resistance against crushing when the tooth was extracted. I shaped the lead as nearly to the size and form of the canal as possible, and forced it in tightly. I then dismissed the patient, expecting in two weeks to remove the tooth. At the end of that time he returned and the abscess was well. That was ten years ago, and there has been no return of the abscess during that time.

He had in his mouth, upon the right side, a first bicuspid in similar condition, which had resisted treatment for a long time, and I determined to try the experiment on that. I filled the roots of this in the same manner, and in five days the abscess was cured, and

remained so for two years. At the end of that time he came to me, and I found the roots were split and there was no alternative but to extract it. Meantime I had been turning over in my mind the question of the cause of the therapeusis in these cases, and had come to the conclusion that it was due to a solution of the lead producing an astringent salt. When the tooth was removed, I found that the lead had projected perhaps half a line beyond the foramen, and under the most powerful lens that I could use I could not discover that the angles on the lead were any less perfect than when I filled the root. This upset in a moment all my theories as to a solution of the lead and the formation of a salt. My brother practitioners, Prof. Smith and others, have reported to me their success in filling roots in this manner, in cases of chronic abscess.

The filling of cavities with lead is as old as the hills, but the idea of curing an abscess by its use was something new. I have pursued this method almost invariably since with almost unvarying success, and should very much like to have a solution of the question of therapeutics that is involved in this treatment. In answer to my investigations it has been suggested that it was the easy adaptation of the lead to the canal and the thorough filling of the foramen which caused the cure. I am aware that the foramen is thoroughly closed by the lead when it is properly used, but not more so than by the intelligent use of the oxyphosphates and chlorides, or by the use of chloro-percha, and some other explanation than that of adaptability must be given. That there is some therapeusis connected with lead I am satisfied, but I have not been able to learn what it is. And it is for the purpose of obtaining this information, if possible, that I have taken the time of the Association.

Dr. Patrick, of Belleville, Illinois: I have found three therapeutic agents of value in my practice. One is peroxide of hydrogen, another corrosive sublimate, and the third nitrate of silver. Of course they have their cousins and relatives in all directions.

I have found corrosive sublimate, five grains to the ounce, a very valuable germicide where I can get directly at the parts. The quantity necessary to use is so small that no danger need be apprehended in the proportions I have named. You cannot get enough on a few fibers of cotton to destroy an ordinary-sized "bumblebee," but you do get enough to destroy any kind of microbe.

In treating cases where there is pus, or diseased cancellated bone, or through a canal in the soft tissues, I would by all means use peroxide of hydrogen.

Oxygen is destructive of red blood-corpuscles, hydrogen of white blood-corpuscles. Pus is principally composed of the latter; hence, when you throw a jet of peroxide of hydrogen into pus it will foam; if you throw it into blood that also will foam, and if you examine afterward with a microscope you will find no corpuscles, either red or white.

In abscess with fistula there is always more or less pus buried in the cancellated structure of the process that surrounds the roots. Peroxide of hydrogen will remove the pus in such cases as nothing else will.

I have found by experience that where there is a fistula, nothing is gained after you get a root-canal thoroughly cleansed and dried by postponing the filling of it, because you can treat the disease better from the outside than by the way of the canal. Now, while peroxide of hydrogen is a good scavenger, it has a deadening influence, especially over soft tissues, and it is better to sluice out the parts with hot or tepid water to which a little alcohol has been added, to induce a healthy reaction.

In indolent sinuous ulcers connected with the antrum, I have found nothing to compare with nitrate of silver melted on the point of a platinum probe; in this manner it can be carried to any depth and restricted to the parts needing its reactionary influence.

DR. SUDDUTH: The tendency of dental therapeutics to-day is towards antiseptic treatment of the oral cavity, and the important question as to which antiseptic or which germicide is best to be used is the one to be determined.

There can be no question that corrosive sublimate is the best known germicide, but its powerfully poisonous properties necessarily render its use restricted.

In root-canals with dead pulps there is nothing to be feared from its application, and it is the drug above all others to use; but we also require germicides as mouth-washes for the preventive treatment of decay, and in those cases we cannot safely prescribe it. There are, however, a large number of other antiseptics that are not poisonous, and among the latest which has been scientifically investigated in the laboratory is the silico-fluoride of sodium. It is non-poisonous, and is given in doses of five or ten grains three or four times daily, but it does beyond question prevent the development of micro-organisms, and my experiments with it lead me to believe that it will be largely used in antiseptic tooth-powders and mouth-washes in the future.

One word in regard to the comparative values of corrosive sublimate and carbolic acid. In cases of alveolar abscess with acute inflammation, the inflammation must be treated antiseptically and antiphlogistically. For this purpose the corrosive sublimate is the best, but in cases of chronic inflammation, while you need a germicide, you also need a stimulant, and for that purpose carbolic acid is the best agent we have.

I have made no experiments with lead, but I am glad our attention has been directed to it. As the gentleman was relating the case the thought occurred to me that perhaps the patient's health had at that time materially changed for the better, and that would explain the healing of the abscess.

The production of pus is due in nearly all cases to micro-organisms, and four things are essential for the development of these micro-organisms: a living germ, the right temperature, the proper media upon which the germs live, and oxygen, in nearly all cases. If you destroy any one of those four conditions you prevent the development of ærobic germs. If you disinfect and thoroughly fill a root-canal you can have no more development of micro-organisms there, and consequently no more trouble. The tendency of all tissues in a normal condition is to destroy micro-organisms.

In filling the root-canals, in all probability, the gentleman used a material that filled them completely, and in this is to be found the needed explanation.

Dr. Peabody: Could there be any action from the arsenic that is found in lead to bring about the result? I should say it was not due to the health of the patient, because the same thing has been demonstrated upon hundreds of others.

Dr. Sudduth: I am very much averse to expressing speculative opinions, and consequently would rather not answer the question.

Dr. Harroun, of Toledo: In answer to Dr. Peabody's question, I do not think there was any therapeutic action of the lead. I think he simply closed up the cavity and prevented constant irritation which had proceeded from the septic matter contained in the canal.

Some years ago we were talking of this same subject in the Ohio State Dental Association. We could not satisfy ourselves as to why we could not cure abscess. Dr. Watt said, "When I was a little boy, I went to get a bucket of water from a spring. A gentleman riding along had in his hand a willow whip. I admired it very much, and I asked him a question about it, and he said he had cut it from a willow-tree. I wanted a willow-tree too, and he said, 'If

you will take your knife and cut me off a little bush I will give you this.' The gentleman then carefully cut off the end and stuck it down in the soft soil near the spring. 'Now,' he said, 'you will have a willow-tree.' I said, 'There are no roots there.' He replied, 'The roots will come out around the bottom of it.'" Every day the doctor went down and pulled up the stick to see where the roots came from, and so he did not get any willow-tree.

The secret is we treat these cases all the time and do not let them rest long enough to get any cure. The doctor filled the canal with lead, sealing it up so that there was no chance for infiltration, and the abscess got well. [Applause.]

DR. INGERSOLL, of Keokuk, Iowa: I thank Dr. Sudduth for the introduction of one word, if he did steal my thunder, and that word is stimulation. There is a tendency in both the medical and dental professions to ride hobbies; that is, when we get hold of a new thing which has the elements of value in it, we push it to the extreme, forgetful of all we have known before. No real cure can be effected until we take into account all the conditions.

In the treatment of teeth with dead pulps it is well enough to have an antiseptic, for it is necessary to overcome the tendency to putrefactive inflammation. But is that all? An operation is necessary also, to close up the foramen. Is that all that is required? In any case of chronic abscess there is a diseased condition of the tissues surrounding the root,—an abnormal production of tissue,—and you can have no cure until the root-membrane is restored to its normal condition. That may be accomplished in the incipient stages under the influence of stimulants; but when the abscess is fully established a caustic must be used which will totally destroy the abnormal tissue.

I am glad that Prof. Wilson, in his very original and interesting paper, called our attention to the cementum, which is always involved in these cases. This tissue may become necrosed after the death of the pulp, and thereby lose its circulation, and afterwards become de-animalized. Before this takes place it may be removed by absorption through stimulation. The living parts may be stimulated to such activity that the necrosed portion will be removed before it becomes de-animalized, but after that it is more often removed by solution,—the solvent being lactic acid.

But I wish to impress especially on your minds the necessity for using a stimulant in the treatment of the tissues surrounding the root and adjacent to the root-membrane. My objection to peroxide

of hydrogen is that, though it is a good antiseptic, it is not a stimulant, and hence cannot be trusted. I have failed utterly with it in some cases until I added a stimulant, and then my success was complete.

Dr. W. H. Morgan, of Nashville: I desire to emphasize the use of carbolic acid as having stimulant as well as escharotic and germicide properties. If there is in our pharmacopœia any agent that stimulates healthy granulation as carbolic acid does, I have not yet put my hands upon it. In treating abscess, where I desire to produce healthy granulation of the parts, I prefer it to anything else. I subscribe to what Dr. Sudduth said upon that subject.

There is sometimes another purpose for which we need a stimulant, as in the case presented by my friend Noel, to produce absorption and induce wasting of the parts. For that I prefer the tincture of iodine. If there is any other remedy better adapted to this end I would like to know it. Medical men use it for the purpose of reducing glandular swellings, and I would like to see it used in the abscesses we are called upon to treat, for the purpose of destroying by absorption the sac which contains pus.

A word as to root-filling. I do not believe there ever was a root filled with chloro-percha. You might inject it until the canal is full, and when the chloroform has evaporated the root is no longer full. If the chloro-percha contracts, as it is fair to presume it does in all cases, you will have a little fiber that simply lies in the canal but does not fill it.

Upon the subject of filling roots with lead, I would answer Dr. Peabody's question by saying that it was a soft material, and it closed the foramen so that that which caused the mischief, no longer had an opportunity to operate. What is the cause of alveolar abscess? The mischief originates within the pulp-chamber, and the gases or bacteria, or whatever causes the trouble, pass out at the end of the foramen, and the abscess is the result. A fundamental principle in the treatment of disease is to remove the cause and trust to nature. The lead, in my judgment, has no therapeutic effect, being only in contact with dead walls.

Dr. Staples, of Sherman, Texas: For years I tried every remedy that was suggested for the cure of chronic or open abscess, with not very satisfactory results, till about thirteen years ago our hilarious friend from Texas—Dr. Storey—suggested an idea to me upon which I have since acted. It was that instead of pumping carbolic acid through the root, as I had been in the habit of doing,

I should use oxide of zinc mixed with carbolic acid as thickly as can be forced through the canal and fistula. The oxide of zinc serves to hold the carbolic acid in place until it destroys the sac. I have been using that remedy for thirteen years, and if I have had a failure it has gone to the other fellow; it has not come back to me. I saw a lady the day I left home who five years ago came to me with both superior central incisors abscessed, with sticks driven through the roots and projecting a quarter of an inch. The teeth had been filled several years, and of course they had been abscessed during all that time. These were successfully treated by the method referred to. After this treatment I use either gutta-percha or oxy-chloride of zinc, and fill the canals to the end.

DR. HARROUN: There is one remedy that I have found very valuable in the treatment of pyorrhea. That is the combination of carbolic acid and caustic potash suggested by Dr. Robinson, of Jackson, Michigan. According to his instructions these have to be ground together for five to eight hours before the mixture will retain a liquid form, otherwise it will be in a semi-pasty condition. I have yet to see the case that has not succumbed in part or entirely to its use. It is both stimulant and astringent, and can be introduced either with a syringe or a bit of silk thread or cotton, and should be left in contact with the parts only for a moment or two, and should not be again applied for three or four days.

Too much treatment is a great cause of trouble.

DR. RAWLS, of Lexington, Kentucky: Some of you know that I hold views upon the subject of the etiology of pyorrhea alveolaris that are opposed to those of at least half of the profession in this land. I believe that the prime cause of this trouble is the action of mercury in some of its forms. I think the disease may be either acquired or hereditary, and that when it is found, in either case, all local treatment is worthless except as an alleviation.

In the numberless cases which are reported as cured, the disease has been brought about not by the action of mercury, but only as the result of depositions of lime-salts, and it is not typical pyorrhea. Those cases which are not cured, and which in my judgment are incurable, have their origin in the action of mercury as before stated.

I do not know what the disturbing element in tomatoes or salt may be, unless it is the chlorine, but their extensive use will inevitably bring about the disease and render the system susceptible to the action of irritants that will cause its continuance.

There are transmitted conditions that render different parts of

the system more than ordinarily susceptible to the action of irritants at certain ages alone.

In the effects of mercury as acquired in the individual you first have ptyalism, with loosening of the teeth, etc., and then you may have a return of the tissues to apparent health. This healthy condition may continue for twenty or twenty-five years, and then this serious form of pyorrhea appears as a later phase of mercurial taint. There seems to be in cases of inherited mercurial taint a condition of susceptibility to disease not only of the membranes surrounding the roots of the teeth, but of those surrounding the bones of the body. In such cases, very slight irritation may cause the tissues to break down and melt away without any power to recuperate.

I have never seen what I call a typical case of pyorrhea alveolaris that has been permanently cured.

DR. W. H. MORGAN: I can tell you how to cure every case.

DR. STOREY: I am glad this subject has been sprung. I live in the hot-bed, the home of this disease. I see more of it every day than of any other trouble that I am called upon to treat. I am glad to learn from one gentleman that a single application of a certain remedy will cure it. That is worth a trip to this Association. The last speaker said mercury was the cause of it! Will he please answer me—What was the mercury taken for?

DR. RAWLS: In the South and West, according to my remembrance, in the early settlements there was a great deal of malaria, and the treatment at that time for nearly all forms of disease was principally antimony, blood-letting, and mercury.

You will find also that in those parts of the country where malaria exists, there are a great many people who crave salt. In eating that they get one of the elements that you have in the preparations of mercury used in the treatment of disease,—viz, chlorine.

DR. STOREY: I am no apologist for disease, but my observation has been and now is that pyorrhea is due not to the action of mercury, but to the disease for which the mercury was given.

THE PRESIDENT: Section VI has a paper on pyorrhea alveolaris, and the discussion of the subject had better be postponed until that paper is read.

SECTION VI.

PHYSIOLOGY AND ETIOLOGY.

Chairmen of the Joint Committee, H. A. SMITH, of the American Dental Association, and R. K. LUCKIE, of the Southern Dental Association.

Dental Implantation.

PAPER BY H. A. SMITH, OF THE AMERICAN DENTAL ASSOCIATION.

SINCE Dr. Wm. J. Younger published his brochure in 1886, the operation of dental implantation has greatly attracted the attention of the dental profession.

While many dentists still regard the operation in the light of a scientific experiment only, others now thoroughly believe in its practicability and predict for it a future of great usefulness.

With the view of obtaining more exact information regarding implantation, the chairman of Section VI of the American Dental Association recently addressed a circular letter to dentists, asking for particulars, first, as to their percentage of success and failure, second, as to the causes of failure, third, as to the manner of attachment, and fourth, as to a possible change of color in the implanted tooth.

Judging from the correspondence which has resulted, we may conclude that dental implantation is not being generally practiced, since but a small number of those addressed had actually performed the operation.

In presenting the subject, we have confined ourselves to the data and observations furnished by those who have had actual experience in the operation; and though many of the observations of those who have not implanted are both valuable and interesting, to embody them in this paper would defeat the intention to be brief.

These data we have tabulated in order to show, first, the percentage of success attained by each operator and from this the average

percentage, and second, the different opinions held upon the questions of attachment, color, and cause of failure.

I regret that I am unable to give the total number of cases which this table represents.

	Per Cent. of Successes.	Per Cent. of Failures.	a. Causes of Failure.			b. Assumption of Color of Natural Teeth.			c. Manner of Attachment.		
			Absorption of the Root.	Unfavorable Conditions.	Accidental Causes.	Do Assume Color of Natural Teeth	Approximately.	Do not.	Vital or Membraneous.	Anchylosis.	Mechanical.
Geo. Cunningham, England	100	0									X
Wm. J. Younger	90	10		X	X		X		X		
L. L. Dunbar	75	25		X		X					X
G. L. Curtis	99	1		X		X	X			X	
H. C. Herring	90	10	X		X			X			
Louis Ottofy	86	14		X	X	X			X		
W. N. Morrison	95	5	X				X		X		
E. C. Kirk	94	6	X			X				X	
W. H. Rollins	100	0						X			
E. T. Darby	100	0				X				X	
M. H. Fletcher	80	20			X		X		X		
Thos. Fillebrown	75	25		X			X				X
J. G. Harper	80	20		X		X					X
L. E. Custer	100	0									X
E. S. Chisholm	33	67		X			X			X	
B. A. R. Ottolengui	93	7		X			X				
J. W. Griffith	60	40			X	X					
Average per cent	85	15									

The sign X denotes the opinion of the several operators as to the problems suggested by the headings *a*, *b*, *c*, and their sub-divisions.

Dr. George Cunningham, of England, reports seven cases of implantation, all successful. He says that he has thus far used only freshly-extracted teeth, and believes that if a tooth is implanted before the death of the organic parts more immediately concerned [the pericementum and cementum], the prospect of union is increased and the loss by absorption decreased.

The theory as to the persistent vitality of the pericementum of dry teeth, he remarks, has no scientific basis and is totally at variance with our knowledge of physiology; therefore, he concludes that Dr. Younger's earlier method of practice was better than his present method.

Dr. B. A. R. Ottolengui, of New York, says the best teeth for implantation are those from healthy young people; and when

extracted, they should at once be placed in a solution to be kept moist. He says also that teeth which show absorption of the root, recession of the gum, injury to the cementum by the forceps in extracting, erosion, or teeth dried until they are friable, should not be used.

Dr. W. H. Rollins, of Boston, says, "I regard the operation as valuable; but the chief difficulty is, to get teeth which I feel sure are from the mouths of healthy persons. I have implanted only fresh teeth, because I consider their use more likely to result in success."

Dr. H. C. Herring, of North Carolina, on the contrary, reports a case in which he implanted in the mouth of a negro seventy-two years old a tooth that had been extracted seventeen years, and the operation was successful.

It appears, then, that we are in need of observations carefully made upon the relative results obtained with fresh and dried teeth. If we are to use only freshly-extracted teeth, the practicability of implantation will, of course, be somewhat limited.

To the question, Do implanted teeth assume the color of the natural teeth in the mouth in which they are implanted, most correspondents have answered that they do approximately. Dr. Younger remarks that they do, if the scion tooth is not too dark or too blue.

Dr. Cunningham says that the fresh teeth implanted by him had never lost their natural color, therefore there was none to resume; but he does not say whether they afterwards assumed another color or not.

We find that dried teeth (if not stained before extraction) are notably lighter and more uniform in color than the same teeth would be in the mouth.

When living teeth are kept dry for an hour or more, during our operations upon them we notice a gradual change in color: they become perceptibly lighter, and their natural color is resumed when again bathed in the saliva. Would this fact indicate that a dried tooth when implanted will, after absorbing the fluids, assume the color peculiar to the other teeth in that mouth? The previous color of the implanted tooth, as well as variations in density, would no doubt modify the result.

Dr. Ottolengui mentions a case in which a blue-white tooth was implanted among yellow teeth, and after six months the scion tooth still retained its original color.

As to the mode of attachment, the correspondence seems to indicate that the question is far from settled in the minds of the profession.

A most important contribution bearing upon the question is a report made in January last, by Drs. Heitzmann and Bödecker, entitled, "Microscopical Examination of an Implanted Tooth extracted from the Mouth of Wm. J. Younger." The tooth had been worn for six months, and practically, at least, was a successful case.

Sections were made from opposite sides of the root. An examination of sections from one side showed the cementum to be intact, and the surface appeared jagged and showed crevices, and there was no trace of the original pericementum. Sections from the other side showed only traces of cementum. The exposed dentine was corroded and pierced by numerous bay-like excavations, resembling the root of a temporary tooth in the process of shedding. The bays were filled with granular protoplasm or giant cells, and in some places bundles of fibrous connective tissue entered the bays in the dentine.

At one point even a small piece of bone-tissue was seen, which was identical with that which is observed during the process of absorption of the temporary teeth.

The granulation-tissue observed, penetrating the cementum and dentine, arose from the newly-exposed alveolus, and entering the bays, as it does, effects an attachment which sufficiently explains the firmness of implanted teeth. These observers deny that in this tooth a living union had occurred between the granulation-tissue of the jaw and the cementum and dentine of the implanted tooth. No revivification of the tissues of the implanted tooth had occurred, yet they think that the chances of success are much better in implantation than in either replantation or transplantation, because of the new and healthy socket.

At a recent meeting of the First District Dental Society of the State of New York, Dr. G. L. Curtis read a paper on the "Microscopical Examination of an Implanted Tooth." In the preparation of the sections and drawings which were shown, Dr. Curtis was assisted by W. M. Gray, M.D., Microscopist to the Army Medical Museum of the United States. The tooth examined was a bicuspid which was freshly extracted at the time of implantation. It had been in use nine months without inconvenience, and, owing to the firm attachment, the root was broken in extraction. After a description of five sections, Dr. Curtis says, "I believe the fixation of the

root was caused by a reproduction of the bone-tissue of the alveolus." The inflammation consequent to the formation of a socket produced an infiltration of osteoblasts or bone-corpuscles in the cement-substance, and the outcome of this process was bony anchylosis. He believes the whole tooth was revitalized.

Dr. E. C. Kirk, of Philadelphia, who reports thirty successful cases out of thirty-three, thinks the attachment that of bony anchylosis or direct union with the alveolus, without intervening membrane. This condition, he says, is manifested by percussing the implanted tooth with a steel instrument, when a peculiar resonance distinctly different from other teeth is produced.

As another evidence of attachment by anchylosis he mentions that in all cases, with two exceptions, the teeth were free from the slight mobility common to normal teeth. Dr. L. E. Custer, of Ohio, also mentions this complete immobility of implanted teeth, yet he believes that no true union ever takes place between cementum and bone, however nearly identical these structures may be.

It will be seen, then, that three modes of attachment include all the opinions reported upon this point, namely: A vital union between the revived pericementum and neighboring tissues; a bony anchylosis; and a mechanical attachment.

The true mode of attachment can be ascertained only by careful microscopical examinations of sections cut through the jaw and implanted tooth in position; and we have reason to believe that such experiments are now being made upon the lower animals and will greatly enlighten us upon this question.

In regard to the percentage and causes of failure, the reports have shown an average of about fifteen per cent. of non-successful cases. Dr. Younger's report corresponds nearly with this, being one failure in ten. He mentions three causes of failure: Unhealthy condition of surrounding tissue, lack of sufficient pericementum on roots, and want of care in keeping the teeth rigid in position. He does not mention absorption of the roots as a cause of failure, yet it is commonly the opinion of those who implant and transplant teeth that they will finally be lost by absorption.

Except Dr. Younger's, in a majority of the cases reported the teeth have not, perhaps, been implanted long enough to show signs of absorption, hence the causes given are other than those of absorption of the roots. Dr. Younger states that all of his failures have occurred within a year, usually within three months after the teeth were inserted.

Dr. Morrison, who reports five per cent. of failures from absorption, says that he invariably retains the scion tooth immovable in a rubber splint securely attached to neighboring teeth. This splint, he says, should be worn a month at least, and he insists further upon perfect cleanliness.

The standard for a successful case of implantation is not satisfactorily fixed. Whether the teeth now implanted and regarded as useful will remain so for a length of time sufficient to justify the pain and slight risk of infection attending the operation, remains to be seen. A person who has had a tooth implanted says that he would prefer to have the operation repeated each year, rather than be compelled to again wear his plate.

It has been shown that replanted and transplanted teeth are short-lived. May we not hope for better results with implantation?

Time must answer the question.

SECTION VI.—Continued.

Points in the Etiology of Pyorrhea Alveolaris.

PAPER BY J. D. PATTERSON, OF THE AMERICAN DENTAL ASSOCIATION.

SINCE reading an article before this body at its annual meeting in 1885, upon "The Catarrhal Nature of Pyorrhea Alveolaris," I have given close attention to the clinical study of the subject, as cases have appeared in my practice. The conclusions reached in the paper referred to have since then, for the most part, been confirmed by cases coming to my notice. The record of these additional cases has already been published and can be found in the "Annual of the Universal Medical Sciences," vol. iii, and the August number of the *Western Dental Journal*, vol. ii.

In again referring to the catarrhal nature of pyorrhea alveolaris, I will state that while I believe the disease is in every instance a true catarrh, yet I do not contend that the origin is always found in contagion from other catarrhal surfaces adjoining the oral cavity. My experience has taught me how rarely we find a considerable catarrhal condition in either the oral cavity, the nasal passages, or the pharyngeal tract, without that condition extending to all of them in a greater or less degree, and yet we may have pyorrhea of the oral cavity—or, as I consider it, a catarrh—without that condition in either of the other tracts. In my experience, however, this is unusual. But we must not argue that pyorrhea is not of a catarrhal nature because we see no point from which the contagion comes. As well, in my opinion, might we argue that no nasal catarrh exists because we cannot see a point from which the nasal passages have received infection. Catarrh has, as I believe, its original seat in the oral cavity through much the same influences that cause it upon other mucous surfaces. Indeed, if the mouth is used for breathing, the mucous surface there is upon strict analogy more

liable to catarrh than even the nose, which is its classic seat, for, in addition to the shock from colds, changes in air temperature, dust particles, etc., which cause nasal catarrh, we have here influences potent for the destruction of the functional activity of the oral mucous membrane, which are not met with in the nasal cavity. There are here the irritations of abnormal stomachic conditions; we find uncleanliness sufficient to poison the whole system, we find the irritation from morbid oral secretions, of salivary calculi, of artificial plates, diseased teeth with decayed and jagged edges, etc., and is it then a matter of surprise that catarrh should attack the oral mucous membrane?

In the pharyngeal vault there is found a bursa, the "bursa pharyngea," a depression in the mucous membrane which is commonly believed to be the seat of post-nasal catarrh owing to the facility with which irritant matter settles there and becomes the seat of trouble. In the mouth every tooth with its gum presents a bursa which also may and does afford lodgment for foreign matter to remain and irritate until the mucous membrane, peculiarly sensitive at this point, weeps out its protest and a true catarrh is soon in full sway.

I am firmly of the opinion, which has been confirmed again and again, that pyorrhea, or catarrh of the oral cavity, exhibits its true and characteristic symptoms when the exciting causes are varied,—*i.e.*, a true pyorrhea is not the result of one kind of irritation or cause, such, for example, as a particular constitutional condition or tendency, or idiosyncrasy, or local condition or irritation, but that its characteristic pathology may be and is exhibited when the original cause may be either local or systemic, simple or complex. I have had in my practice as well-marked pyorrhea, with pockets, and pus oozing upon pressure, upon the palatal surfaces of teeth from the irritation produced by a constantly worn and carelessly cleaned partial plate, as I have ever seen produced by causes more obscure or systemic; the only point of difference being that the disease was confined to the palatal surfaces pressed upon by the plate. The claim therefore sometimes made that true pyorrhea is totally different from the gum irritation found in local irritation is not, I think, well grounded. The disease, therefore, whether from local cause or constitutional tendency or dyscrasia, merges into the same pathological changes, exhibiting in its later stages the same destruction of tissue and calcareous deposits; just as catarrh of the nose, whether from systemic or local causes, will finally cause the same

pathological changes, hypertrophy of tissue, destruction of bone, and deposits of calcareous matter.

In complications of catarrh we find that a "vicious circle" is established. I quote from "Ziemssen's Encyclopedia," vol. iv, p. 141, "The fluids retained may throw down chalky deposits and thus form stony concretions;" "hyperplasia of the membranes may lead to actual new formations and polypoid excrescences;" "'a vicious circle' is established: all these processes being able to induce chronic rhinitis, *and being in turn produced and maintained by that disease.* Chronic catarrh may also involve neighboring parts. It may extend posteriorly into the pharynx, or anteriorly into the epidermis. *The cavities adjacent to the nose may also be attacked.*" "The most familiar are the processes that take place in the cavity of the upper jaw, which may thereby be distended, and present the affection known as '*Hydrops Antri Highmori.*' In this way caries of the bones may ensue, even of those belonging to neighboring cavities and entering into the formation of the base of the cranium. The inflammation is more likely, however, to spread to the skin surrounding the nostrils. This becomes infiltrated and swells, while excoriations of the upper lip and swelling of the glands of the neck combine to present a picture of 'the scrofulous habitus' as taught in the books." I also quote from Cohen on "Diseases of the Throat and Nose," in regard to calculi in nasal catarrh, as follows: "Calculi, as before mentioned, are occasionally met with in the nasal passages. They are due sometimes to a foreign body which has been forced into the nose and eventually becomes converted into a nucleus for the deposit of calcareous matter; in other cases they have been found to be due to a deposit of the inspissated mucus or sanguinolent secretions from the inflamed mucous membrane."

I make these quotations to bring additional testimony to my claim made in my first article before this body as to the identity of the calcareous accretions found in nasal catarrh and pyorrhea alveolaris. In the light of recent study upon the subject I cannot account for the opinions of some well-known dental writers as to the origin of the deposit found well up on the roots of the teeth affected by this disease. Now, as a matter of fact, all prominent pathologists agree that accretions may make their appearance as a deposit from purulent matter from inflamed territory *in any part of the human body.* Upon this subject I desire to quote, in proof of this statement, from the recently issued "Hand-Book of the Medical Sciences," vol. i, p. 743. "Calcification consists in the abnormal

deposit of earthy matter in or around the elements of a tissue, or *in the morbid product of a pre-existing inflammatory process.*" "The circulation of the blood may be retarded and thus favor the precipitation of the calcareous matter which it normally holds in solution." "Calcification rarely if ever depends solely upon general causes; there is always a local influence, very often it is due to a pre-existing chronic inflammation. Old accumulations of pus, extravasations and exudations, are exceedingly prone to calcification." "*A mere loss of function predisposes to calcification.*" With regard to the immediate nature of the process involved in the deposit of lime-salts there is some difference of opinion. The simplest mode of explanation is as follows: "A certain amount of calcareous matter is a normal constituent of the blood, in which it is held in solution by the carbonic acid always present in sufficient quantity to keep in solution twice the normal amount of earthy matter. When the circulation is impeded, the carbonic acid, because of its great diffusibility, is readily absorbed by the tissues or goes to form new compounds, necessitating a precipitation of the calcareous matter. *This is likely to occur in all tissues of the body.*"

With these facts before us, does the presence of lime-deposits in the pockets of pyorrhea alveolaris still surprise us, and must we yet indulge in vague surmises over its presence?

To my mind the other pathological symptoms in nasal catarrh and pyorrhea are as clearly noticeable and identical as are the deposits in both diseases. In the oral cavity the deposit is more frequent and is seen earlier than in nasal catarrh only because the anatomical structure in the mouth affords readier points for its seclusion and aggregation. As I have previously considered before this body the identity of other pathologies met with in these diseases, I will not here go into that subject.

Of interest in this connection is a report of the recent meeting of the American Otological Society. In a discussion upon the "reflex influences in the production of naso-pharyngeal catarrh," Dr. A. H. Buck, of New York, said, "The object of my paper was to call attention to those comparatively remote exciting causes of naso-pharyngeal catarrh which act, so far as it is possible to explain their mechanism, through the intervention of the nerve system. We know little of the direct exciting causes of naso-pharyngeal catarrh. The most common indirect cause is chilling of the surface of the body. *According to certain authority, affections of the teeth should rank next in order of frequency.*" Dr. Samuel Sexton

also said, "*I have seen many cases in which irritation in the mouth has been the cause of naso-pharyngeal catarrh and aural symptoms.*" To me these remarks, pointing to irritation in the mouth as a cause of catarrh in the nose and pharynx, point the dental profession also to another thing, and that is, that if we are slow to admit of catarrh in the oral cavity, we will soon be compelled to do so by weight of testimony from the medical profession. The irritation these men speak of could scarcely be attributed to transient dental lesions, but rather to the prolonged irritation and contamination from pyorrhea alveolaris.

As additional evidence upon the question, I have now to point you to the usual presence of pyorrhea and catarrh of the nose in persons having cleft palate. About one year and a half ago, a patient wearing an artificial obturator of Dr. Kingsley's was sent to me to have the broken plate repaired. In working over the case I quickly observed the presence of fetid chronic catarrh of the nasal passages, and also pyorrhea alveolaris in the mouth in its advanced stages. The patients for whom I had in past years made artificial vela may or may not have been afflicted in the same way,—my attention had not then been directed to the study of pyorrhea,—but since observing the marked case to which I have referred I have examined three other cases of congenital cleft palate, and in two found both pyorrhea and naso-pharyngeal catarrh. The third patient was without any teeth. I think it not unlikely that in these cases, where function is so largely destroyed and where so often a dyscrasia exists, catarrh will generally be found present. This can be proved or disproved by a continued record of such cases. It could scarcely be expected, however, that catarrh in these cases could be present in the cavity of the nose or of the mouth without being present in both, the facility for contamination being so largely increased through the opening of the cleft.

To the theory of oral catarrh the objection has been raised that when the affected teeth are lost by extraction or drop out through destruction of their sockets, the disease will thereupon rapidly disappear; and it is argued that were it catarrhal it would continue. I answer, that were it not for the peculiarly favorable conditions made by the presence of the teeth catarrh would not be possible. But the many depressions existing at the gum edge around the teeth, which are often augmented by neglect and accident, afford just the opportunity for the origin of catarrhal symptoms; they

are the bursæ corresponding to the depressions in the nasal mucous membrane which there give catarrh its seat. When the teeth are gone the diseased places are soon drained and obliterated, and the mouth then presents a dense mucous membrane which is being constantly cleansed, and the presence of catarrh is rendered impossible. Were the nasal passages as readily cleansed as the mouth without teeth, and the membrane as insensible to irritation, then, I apprehend, no nasal catarrh could exist.

In regard to the question of whether pyorrhea is of constitutional or local origin, the opinion of the writer has been foreshadowed in the foregoing remarks. I believe that a true pyorrhea is catarrhal, and like catarrh of all mucous surfaces the causes may be both systemic and local, or they may be entirely local. I believe that the common cause of pyorrhea is found in local irritation, frequently combined with some predisposition which may be either hereditary or acquired, and which lends to the virulence of the symptoms just in proportion to the loss of function or weakening of function produced by that predisposition, but that pyorrhea is seldom, if ever, the result of systemic causes alone; while, on the other hand, local irritation is unquestionably often the only factor in the origin and maintenance of the disease.

SECTION VI.—Continued.

The Incipiency of Dental Caries.

PAPER BY LOUIS OTTOFY, OF THE AMERICAN DENTAL ASSOCIATION.

DENTAL caries is in many respects one of the most peculiar diseases by which any part of the human body is liable to be affected. While many vague theories exist regarding its cause and prevalence,—climate, nationality, race, age, social condition, and other circumstances are supposed to influence it,—it is indeed remarkable that dentistry should have progressed as it has, with so little known of the facts concerning the general condition of the organs to which the members of our profession devote their time. Nearly all the information accessible is based on unreliable observation. The office of the dentist is not the proper place to observe and form opinions as to the prevalence of caries; neither are the poor-houses, hospitals, infirmaries, etc., proper places to secure reliable statistical information as to caries and other diseases or conditions of the mouth. For neither the dentist's office, nor the public institution established for specific purposes, contains or is visited by a number or class of people who are representative. They frequent or are inmates of these places for specific objects. Those who, man for man, and woman for woman, will fill our places in the next generation, are the ones to be examined, and these in civilized countries, as a general rule, are found in the public schools. In view of the necessity of undertaking the work of examining and tabulating the condition of the teeth of school-children, and in order to facilitate the investigation, the inquiries below are submitted.

"As there is a wide-spread belief among the medical as well as the dental profession that the teeth of man degenerate in proportion as he advances from a savage to a civilized condition, and as the literature of our own profession, in treating of the causes of the decay of the teeth, invariably attributes it to physical degeneracy conse-

quent upon man's artificial mode of living, it is certainly time that those who rely upon this hypothesis as an explanation of disease be called upon to furnish not only opinions and inferences, but proofs of a conclusive character of their assertions.

"1st. Are more people subject to nervous diseases now than formerly? And if so, do such people suffer more from diseases of the teeth than those who are not so afflicted?

"Man in a barbarous or uncivilized condition acts upon impulse, whereas the civilized man reflects before he acts, for it is only by the exercise of this reflective quality in man that he becomes civilized, and the shortness and misery of savage life must be taken into account in making up statistics on this subject.

"2d. Are diseases of the teeth more common now than formerly?

"Ancient and modern history, poetry and old works on medicine, record diseases of the teeth, as well as the supplying of their loss by artificial means. Prehistoric skulls should be examined and tabulated; and to be of scientific value not a few, but many, should be so treated, for if decay of the teeth is found even in one skull out of one hundred, the fact would be established that the teeth of prehistoric man *were subject to decay*, and further examination would establish the degree.

"3d. Are the majority of human teeth in the present age in a good or bad condition?

"We need statistics on this subject, for by far the largest number of people who visit a dental office are the class who have bad teeth. They are driven there by necessity, and it takes a great advance in civilization for persons to consult a dentist in regard to the condition of their own or their children's teeth before they suffer pain or inconvenience; so that statistics in regard to the condition of the human teeth based upon what may be seen in a dental office are of little value. Yet it is a fact that the greater part of what has been said on the increasing degeneracy of the human teeth has been compiled from the general impressions received by the dentist in the practice of his profession through a series of years; and by careful observation and an increasing practice he is forced to the conclusion that human teeth are degenerating. I am well aware that a successful practice, coupled with close observation, is entitled to respectful consideration as such, but for scientific purposes touching the degeneracy of the human teeth, an office practice is too limited a field of observation to be of value.

"4th. Are the teeth of people living in the United States worse,

or more disposed to decay, than the teeth of people living in Europe?

"It is a common belief that the American's teeth are worse than the European's; and some of our profession, with an industry little short of tyranny, have done much by their writings to foster that belief. They have taken no pains to formulate tables, but have collected their statistics from the babblings of homesick servant-girls, and the vaporings of recent immigrants who are hardly naturalized or acclimated before they are afflicted with an 'American toothache.'"*

In other countries some attention has been paid to this work. Mr. Fisher, of Dundee, Scotland, has conducted some examinations recently at a naval school. Of the four hundred pupils from ten to sixteen years of age examined at that institution, eighty had sound teeth, while over three hundred were in need of dental services. As the children selected for these institutions are supposed to be strong, healthy, and well developed, and were chosen for these physical qualities, what might not the condition be in others less developed? In an "Industrial School for Girls," among eighty-five of the inmates, ranging from seven to sixteen years in age, sixteen had sound teeth, while in sixty cases the teeth were more or less carious.

Magitot, Tomes, and others in Europe, Hitchcock, Black, Patrick, and others in this country have also made examinations and tabulated the results of their investigations. While all these tables are of much value and furnish a great deal of information, they fall short of what is desired. They only show the relative proportion which prevails among carious teeth; that is, how many incisors, and how many molars, etc., would be found in a carious condition if people were examined at random. An attempt has been made by Magitot to determine the ages at which certain teeth are most affected, but the difficulty has been that the numbers from which the averages were made were not sufficient to cover the attempted period from eruption to the age of seventy. His observations have led him to say,—

"We notice that, generally speaking, caries affects the upper more frequently than the lower teeth: the figures giving 6004 upper against 3996 lower, or about 3 to 2. Yet we find that this proportion, true for the teeth as a class, is not so for the first and second

* Dr. John J. R. Patrick, Trans. Ill. State Dent. Soc., 1882, pp. 151, 152.

molars, in which caries is more frequent in the lower jaw. Comparing the opposite sides of the same jaw, we do not find a difference sufficiently marked to be taken into consideration, and may assert that caries is equally frequent on the two opposite sides of the same jaw. The two sexes present a difference in the predisposition to caries which, although slight, is worth noting; thus, in a total of 1000 cases in adults we have found 583 in the women and 417 in the men, placing the sexes from this point of view in an approximate ratio of 3 to 2.

"The age of the patients and the period of the greatest frequency of caries ought likewise to be determined. Considered as a whole, we see that caries in the deciduous period affects the upper jaw by preference; for in a total of 1000 cases, 543 are found for this against 457 for the under jaw.

"The tooth most frequently attacked is the first molar; then follow successively the second molar, the lateral incisor, the central incisor, and lastly, the cuspid. For the three last the malady is much more common in the upper jaw, while for the two molars the relation is inverse, dispositions which recall those of the permanent teeth.

"As regards the age at which, in the child, the malady appears, without having applied to this the graphic tracings, we are yet able to give some indications: thus it is at about the third or fourth year that we first observe caries, and its frequency increases from this moment in a regularly progressive manner, up to the age of twelve, the average period of the loss of the last deciduous tooth.

"The French law exempts from military service, first, when there is a loss or caries of the incisors or cuspids of one of the jaws; second, when there is a loss, caries, or bad condition of the majority or of a large number of the other teeth." *

Hence in France much attention has been given to the examination of the teeth of conscripts, and while no definite reason is assigned it is well known from which of the eighty-six departments of France come those who possess the best teeth, and Magitot gives a table showing such location.

That much importance is attached to the fact that the teeth should be examined in various countries systematically, may be seen from the variation between Magitot's and Hitchcock's tables. The different teeth are not equally subject to the attacks of caries; in

* Magitot's Treatise on Dental Caries, Chandler.

the first place, the upper are more frequently attacked than the lower, according to Dr. Magitot (*op. cit.*, p. 48), in the proportion of 3 to 2; while the yet more comprehensive tables of Dr. Hitchcock give the ratio of 1.9 to 1 (or very nearly two to one), the first and second lower molars, however, suffering even more frequently than the corresponding teeth. There does not appear to be any noteworthy difference between the two sides of the mouth in their relative liability to caries.

Tables drawn up by various observers correspond in their main features with one another. "Those drawn up by Dr. Hitchcock differ in some particulars of interest. Thus in his tables, the carious first molars do not show the great preponderance in numbers over all other teeth which is exemplified in most other tables; and as his tables embrace fillings as well as extractions, this cannot be attributed to the early attention given by Americans to their teeth."*

"Dr. Magitot's second table of 2000 cases combined with the first of 10,000, analyzed, shows 4971 carious lower teeth as against 7029 upper teeth, or, excluding the incisors and cuspids of both jaws, in consideration of the well-marked immunity of lower incisors and cuspids, 4951 carious upper molars and bicuspids, as against 4611 lower molars and bicuspids. Of these, lower molars furnish us with 3616, as against 2902 upper molars, so that the protective effect which helps lower teeth is not efficacious at the back of the mouth, indeed becomes less efficacious as we go backwards from the incisors; this would seem to confirm the idea that it is the secretion of the submaxillary glands that is the protective agency.

"The female sex is distinctly more liable to dental caries than the male, though in what proportion the caries occurs remains uncertain, for the want of sufficient data; so that different authors arrive at widely different estimates. The patient's age, likewise, markedly influences the disease; thus, if it has not occurred before the age of five-and-twenty, there is a strong probability of immunity till about the fiftieth year, when, coincidently with other manifestations of bodily decline, the teeth again become liable to be extensively attacked with caries." †

Parreidt has the following on this subject: "According to my statistical examinations, which extend to over 13,000 decayed teeth, the caries may be arranged in the following group:

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* Tomes's Dental Surgery. Third edition, 1887.

† Ibid.

Printed by Section VI, Physiology and Etiology, American Dental Association.

No.

Name,

Sex: Male. Female. Age: Color: WHITE.

Nativity of
- *a* Father:
- *b* Mother:
- *c* Subject:

Occupation of
- *a* Father:
- *b* Mother:
- *c* Subject:

Color of Hair: Eyes:

Features

Examination conducted by

188.....

Degree of Cleanli... Marked from 0 to 10.

☞ Decay.

☞ Fillings.

☞ Unsalvable Teeth.

☞ Extracted Teeth.

	Per cent.
First inferior molar	20.6
Second inferior molar	14.1
First superior molar	12.4
Second superior molar	8.4
Third inferior molar	6.7
First superior bicuspid	6.3
Second superior incisor	5.6
First superior incisor	5.2
Second superior bicuspid	5.1
Third superior molar	4.3
Superior cuspid	3.8
Second inferior bicuspid	3.2
First inferior bicuspid	2.8
Inferior cuspid	0.6
Inferior lateral incisor	0.5
Inferior central incisor	0.4

"Aside from this I have ascertained that one hundred carious teeth on an average are composed of twenty-six incisors and cuspids, twenty-eight bicuspids, and forty-six molars. Of the incisors and cuspids, on an average ninety-six per cent. decay on the approximal, and only four per cent. on the incisive, lingual, and labial surfaces. The bicuspids also decay most frequently (ninety-two per cent.) on the approximal surfaces, and only the molars decay most frequently (seventy per cent.) on the masticating surfaces, while on the approximal surfaces the percentage is twenty-eight, and on the labial and lingual two per cent." *

But these inquiries should be pushed further. Not only should we understand the relative percentage of decay, but its prevalence at each age and what if any influences bear upon increasing or decreasing it. Then, also, the proportion of the sound to the unsound teeth should be determined, so that an approximate conclusion may be arrived at as to the relative condition of the teeth at various ages.

This paper is presented at this time not so much for the value, if any, which may attach to it because of its statistical nature, as for the purpose of again calling the attention of the profession to the work which should be done, and to enlist the services of others. The Section on Physiology and Etiology of this Association has had 5000 blanks (see accompanying chart) printed, and the members of the Association should each contribute his share, to present at the meeting next year the report of 4000 or 5000 examinations. This

* Parreidt's Compendium of Dentistry. Translated by Louis Ottofy, 1889.

would cover about 100,000 teeth; a sufficient number from which to draw entirely reliable data. In the work which I have done the information sought has not been as extensive as I have desired. The cases on which I report show the density of the enamel, classed as hard, medium, and soft; the presence or absence of salivary calculus at the various ages, as also the healthy or diseased condition of the soft tissues, the regularity or corresponding irregularity of the teeth, the prevalence of caries at each age and in each particular tooth, right and left side, and the response to a test of the mixed saliva.

The inquiry could be extended by ascertaining the nationality of the child and its parents and the influence of the same on caries, also the occupation of parents, or social condition, and hence secure the information in reference to the supposed deleterious influence of high living upon tooth-degeneracy; the color of hair and eyes, the features and occlusion and their bearing upon the quality of tooth-substance or their liability to destruction, as also the influence of general health.

Careful tests of the parotid, submaxillary, and sublingual saliva, as each issues from its duct or ducts, could at the same time be made.

Inquiry as to the influence of hygienic means, the use of brushes, dentifrices, etc., upon the condition and cleanliness of the teeth, and the relation of the color of caries to the rapidity of its progress, could thus be observed; also to what extent salvation of the teeth is prevalent, the relative influence of the extraction of permanent teeth on those remaining (as for instance the first molar), and the change of position of the adjoining teeth; the cause of stains upon the teeth, the early deposition of salivary calculus and the causes leading thereto; grooves and pits in the enamel and their causes, and the question of the earlier eruption of teeth on the one side than on the other. These and many more vague questions can be solved in this way only. But it requires time to do it, and many should engage in the work in many parts of the country. About ten minutes are necessary to make the examination of one child's mouth, and to properly record it on a blank. Thus if one person would devote one hour a day throughout the school year, Saturday, Sunday, holidays, and vacations excepted, scarcely one thousand children could be examined.

The records thus obtained would grow more valuable, and could be used in the future by re-examining the same children for purposes of comparison, thus noting the improvement or degeneracy

of the teeth and the causes leading thereto. In this connection the examination of skulls now in the various museums of this country may be recommended again, and steps ought to be taken by this Association to have the work accomplished, that the valuable information within such easy reach, in regard to the condition of the teeth in past ages and among various tribes and nations, may be noted and tabulated.

The number of children I wish to report on at this meeting is 623, consisting nearly half and half of males (317) and females (306), and ranging in age from five to fifteen years. Of this number only forty-eight had perfectly sound sets of teeth, which would indicate that the teeth of only something over seven and a half per cent. are sound before the age of fifteen. Of the males about ten per cent. (thirty-two in number) and of the females slightly over five per cent. (sixteen in number) had perfectly sound sets of teeth. The number of teeth examined, their cavities classified and tabulated, is as follows:

Sound teeth.			
Temporary	8225		
Permanent		7600	10,825
Carious teeth.			
Temporary	1875		
Permanent		1944	3,819
	5100	9544	14,644

Some of the children were examined in the public school at Grand Forks, Dakota, others at Lebanon, Illinois, and at Chicago, Illinois. The table shows over 34 per cent. carious and less than 66 per cent. sound. Of the 1944 permanent carious teeth, only 53 had been attended to by filling or otherwise, and about 1 per cent. of the carious permanent teeth had been extracted. The number of teeth equally divided would give each child 17.37 sound, and 6.13 carious teeth.

The mixed saliva in each instance was tested with a reliable quality of litmus paper, but no attempt was made at these examinations to distinguish the different kinds of saliva as they issue from their respective channels. About two-thirds of the examinations were made before meals and one-third after meals. No marked difference was observed as to time of making observation. The chemical reaction was as follows:

TABLE SHOWING REACTION OF MIXED SALIVA AT DIFFERENT AGES.

At 5	years	of	age	75	per cent.	neutral,	25	per cent.	acid, and	0	per cent. alkaline.
6	"	"		61	"	"	39	"	"	0	" "
7	"	"		61	"	"	39	"	"	0	" "
8	"	"		84	"	"	14	"	"	2	" "
9	"	"		67	"	"	31	"	"	2	" "
10	"	"		77	"	"	16	"	"	7	" "
11	"	"		73	"	"	27	"	"	0	" "
12	"	"		69	"	"	30	"	"	1	" "
13	"	"		74	"	"	22	"	"	4	" "
14	"	"		90	"	"	10	"	"	0	" "
15	"	"		65	"	"	29	"	"	6	" "

The average of the chemical reaction between the ages of five and fifteen years was 72.36 per cent. neutral, 25.64 per cent. acid, and 2 per cent. alkaline. This result will be found to vary only minutely in even the largest number of observations. My former observation that in cases of neutral saliva, caries is less frequent than in cases of either acid or alkaline saliva has been confirmed by these examinations. The acidity or alkalinity of the saliva may be due to the presence of caries.

The density of the enamel was found to vary considerably at different ages. The average as shown by actual examination during the ages from five to fifteen years is 44.90 per cent. hard, 45.50 per cent. medium, and 9.60 per cent. soft, which seems to prove that the density of the enamel is somewhat below the average during the eruptive period.

TABLE SHOWING DENSITY OF ENAMEL AT DIFFERENT AGES.

Age.	Hard.	Medium.	Soft.
5	37½ per cent.	62½ per cent.	0 per cent.
6	33½ "	56½ "	10 "
7	23½ "	60 "	16½ "
8	38 "	50 "	12 "
9	35 "	47 "	18 "
10	45 "	49 "	6 "
11	43¾ "	46¾ "	9½ "
12	51½ "	39½ "	9 "
13	62 "	26 "	12 "
14	70 "	23 "	7 "
15	53 "	41 "	6 "

The presence of salivary calculus amounted to 9.64 per cent. The greatest number of cases were found between the eleventh and thirteenth years, and in almost all of the cases where calculus was present the saliva was in an acid condition.

TABLE SHOWING PRESENCE OF SALIVARY CALCULUS AT DIFFERENT AGES.

Age.	Presence of Calculus.	Absence of Calculus.
5	14 per cent.	86 per cent.
6	4 "	96 "
7	3 "	97 "
8	2 "	98 "
9	6 "	94 "
10	8 "	92 "
11	17 "	83 "
12	16 "	84 "
13	20 "	80 "
14	10 "	90 "
15	6 "	94 "

The diseases of the soft tissues were confined to irritation and inflammation of the gums, mostly caused by the presence of calculus. The average of diseased cases was 4.9 per cent., and disease was found to be most prevalent at the age of eleven, at which time fourteen per cent. of the children were affected.

TABLE SHOWING PRESENCE OF DISEASES OF THE SOFT TISSUES AT DIFFERENT AGES.

Age.	Diseased Condition.	Healthy Condition.
5	0 per cent.	100 per cent.
6	2 "	98 "
7	2 "	98 "
8	1 "	99 "
9	2 "	98 "
10	5 "	95 "
11	14 "	86 "
12	9 "	91 "
13	1 "	99 "
14	8 "	92 "
15	10 "	90 "

The irregularity of the teeth was most marked at the eighth year of age, at which time of life 43 per cent. of the cases were found to be irregular. The average irregularity amounted to 24.13 per cent.

TABLE GIVING PERCENTAGE OF IRREGULARITY OF THE TEETH.

Age.	Irregular.	Regular.
5	0 per cent.	100 per cent.
6	9 "	91 "
7	27½ "	72½ "
8	43 "	57 "
9	14 "	86 "
10	31½ "	68½ "

Age.	Irregular.	Regular.
11	82½ per cent.	67½ per cent.
12	25 "	75 "
13	20 "	80 "
14	35 "	65 "
15	28 "	72 "

Among these children there was only one marked case of hereditary syphilis,—that is, with the specific markings of the teeth described by Hutchinson. There were two cases of what is known as chemical abrasion, one a boy of fifteen whose four inferior incisors were thus affected, and the other a girl of twelve whose superior right central incisor was affected. In two instances (boys ten years old) the inferior left temporary lateral incisor and cuspid were found united by fusion of their crowns; while in another instance, a boy of the same age, the upper right temporary lateral incisor was fused to a supernumerary; and in a boy twelve years of age, the permanent upper right lateral incisor was also found fused with a supernumerary. In addition to these cases of abnormality, I observed two supernumeraries immediately posterior to the upper permanent central incisors, one in a boy of nine, and the other in a girl of eight.

Of the 5100 temporary teeth examined, the following were the percentages of sound and carious teeth:

	Sound.	Carious.
Inferior central incisors	99.07	.03
Inferior lateral incisors	99.01	.09
Superior central incisors	98.68	1.32
Superior lateral incisors	98.58	1.42
Inferior cuspids	98.01	1.99
Superior cuspids	97.22	2.78
Inferior first molars	93.48	6.52
Superior first molars	93.28	6.72
Inferior second molars	92.20	7.80
Superior second molars	90.23	9.77

Of the 9544 permanent teeth examined, the following was the percentage of sound and carious teeth:

	Sound.	Carious.
Inferior cuspids	99.99	.01
Inferior central incisors	99.96	.04
Inferior lateral incisors	99.95	.05
Superior cuspids	99.95	.05
Inferior first bicuspids	99.90	.10
Superior second bicuspids	99.72	.28
Inferior second bicuspids	99.70	.30

	Sound.	Carious.
Superior first bicuspids	99.62	.38
Superior lateral incisors	99.45	.55
Superior central incisors	99.15	.85
Superior second molars	98.75	1.25
Inferior second molars	98.43	1.57
Superior first molars	92.80	7.20
Inferior first molars	92.30	7.70

No marked difference seems to exist between the two sides of the jaw, so far as liability to caries is concerned. According to the following table, showing the condition of 9544 permanent teeth, there is but a very slight difference:

CONDITION OF 9544 PERMANENT TEETH.

	Sound.		Carious.	
	Right.	Left.	Right.	Left.
Upper	1895	1954	504	507
Lower	1916	1835	448	485
Right side, sound	3811			
Right side, carious			952	
Left side, sound		3789		
Left side, carious				992

By the following table we can observe the greater prevalence of decay among females than among males at the different ages:

TABLE SHOWING THE PREVALENCE OF CARIES AT THE DIFFERENT AGES DURING THE ERUPTIVE PERIOD OF THE TEETH.

Age.	Per cent. in Males.	Per cent. in Females.	Per cent. in Both.
5	16	37½	26¾
6	34	25½	29¾
7	32½	50½	41½
8	34⅛	33¾	34
9	34	44¾	39⅛
10	31	31	31
11	24½	24¾	24½
12	24	24½	24¼
13	21¾	27½	24¾
14	22⅛	30	26
15	25	30½	27½

It will thus be seen that when computing both the temporary and permanent teeth together, as well as separately, caries is more prevalent among girls than among boys: amounting in the former

to 37½ per cent. at five years, being never less than 24 per cent., and sometimes as high as 50 per cent.; while in boys the maximum at any one age was 34 per cent., and the minimum 16 per cent. At all ages during the eruptive period caries was more prevalent, on an average, among females than males by 5 per cent. The proportionate ratio is about the same during the eleven years of life covered by these statistics. The total average at all ages among these children was 27½ per cent. in males, 32⅝ per cent. in females, and 30 per cent. in both. This therefore seems to indicate that at least thirty out of every hundred teeth are carious before the age of fifteen years is attained, and sometimes over 20 per cent. of those of the permanent ones which are erupted at these ages are already affected. By the computations made from these examinations it was shown that these children average over twenty-three teeth each; of these about fifteen are permanent, and three of the fifteen have been attacked by caries.

I will not take up your limited time by explaining the figures and facts as shown by these charts, but merely call your attention to them now and invite your perusal of them when published in the Transactions.

DISCUSSION.

DR. GENESE, of Baltimore: Two of the most useful preparations I have found for the treatment of pyorrhea, have been boracic acid and aromatic sulphuric acid. The first process in the treatment is to thoroughly cleanse all the roots with a very fine, slightly curved instrument, then to thoroughly syringe out the pockets with aromatic sulphuric acid diluted with one part of distilled water, and let the patient use night and morning a powder composed of one drachm of boracic acid and one ounce of precipitated chalk. To this treatment the disease succumbs very readily.

DR. STOREY, of Dallas, Texas: Just as I had got fairly started out after that remarkable statement of Dr. Rawls's, the gavel was brought down. I asked him what they took calomel for, and he went on to tell me, for a good many things, and I stated that they took it because they were sick. If his observations on which he bases his premises be correct, pyorrhea alveolaris was the result of the remedy and not of the disease. As I stated, I am here not to defend diseases but to defend the remedies. I am satisfied that a great many of the cases that we see would not have occurred if the patients had taken more calomel. I mean of those who live South

in malarial regions. I live where calomel is an absolute necessity. Under the new theory of micrococci being the cause of disease, we are told that mercury is a sheet-anchor. We are told that there is nothing to compare with bichloride of mercury as a destructive agent of microbes. Calomel is the next agent to that, acting only in a milder way. It does the same thing as a systemic agent that the bichloride does as a local agent. It would do the same thing as a local agent, but it is not soluble and is not as easily available. Those of us who practiced medicine on horseback for a great many years remember very well what an efficient remedy the local application of calomel was for our sore-backed horses.

Pyorrhea alveolaris in my opinion is a constitutional disease, and in many cases it comes of some of those iniquities of the fathers which are visited upon the children to the third and fourth generations. There is not a man in this assembly to-night who dares say he is not contaminated. I would not dare to say it of myself. No man can tell just how much of it he has. This is a broad statement, but it cannot be controverted.

This disease of pyorrhea exists in my country to an extent beyond anything else. It is found in all forms and degrees. I cannot cure it. I practice all the treatments that are recommended, without avail. Some cases will apparently get well and in six months the patient will come to me again as badly off as ever. Before we shall be able to successfully treat this disorder, which I say is constitutional, we will have to go back three or four generations and remodel the whole of our anthropogenesis.

In my treatment, aromatic sulphuric acid is, in the beginning, my sheet-anchor. I use it in full strength, and fill the pockets with it to destroy all micrococci. It softens the tartar and does not in the least injure the teeth. After I have perfectly cleansed the teeth I put my patient upon a prescription as follows: Two ounces of prepared chalk, one ounce of lac sulphur, and a half-ounce of borate of soda, mixed well to a fine powder. This I have them use on their teeth every night on retiring. Absolute cleanliness on the part of my patients I cannot secure; few of them will keep their teeth clean, but those whose teeth are kept in the very best condition suffer with the disease.

Some years ago a gentleman came to me with one of his wisdom-teeth affected. I took it out, and though all the other teeth were apparently in good condition, I said to him, "You will lose the next one in about four months." I put him under a course of treatment,

and in four or five months he came to me with both the second molars in the same condition,—with all the process gone. I continued to remove his teeth at intervals until all were gone. In that case the disease was progressive.

DR. W. H. MORGAN, of Nashville, Tenn.: Didn't you cure the disease when you took out the teeth?

DR. STOREY: No, sir.

DR. MORGAN: It didn't get well?

DR. STOREY: The tooth got well.

DR. MORGAN: Did the gums get well?

DR. STOREY: Yes.

DR. MORGAN: The alveolar process?

DR. STOREY: Yes.

DR. MORGAN: Where was there any disease, then?

DR. STOREY: That man spent months and months at Waukesha, and he is not well yet.

DR. PEIRCE: What is the object of the sulphur in the prescription you gave?

DR. STOREY: To kill the bugs.

DR. MARSHALL, of Chicago: The following case, presenting some features in its treatment out of the general order, has recently been under my hands:

A lady came to me with the left upper central incisor badly diseased from pyorrhea. The anterior alveolar wall was entirely gone, and a good share of the posterior wall. There was an attachment of the tooth on the posterior or palatal surface only. The tooth could be rotated by the fingers, and was elongated about a quarter of an inch. The lady desired to have it extracted. I determined to try replanting. I took an impression of the teeth as they stood in the mouth, in plaster of Paris, and had a splint swaged from gold plate which would cover the lingual surfaces of the six anterior teeth, and extending over the cutting-edge enough to get a bite upon them. I then extracted the tooth. Upon the labial surface of the root, well towards its apex, were three little points of calcareous deposits, all together not as large as a pin-head, and the pericementum on the palatal surface was considerably thickened. I opened the canal, and found a living pulp, which I removed, and then filled the canal, treating the root with a solution 1–500 of bichloride of mercury. I then drilled into the jaw enough to enable me to replace the tooth in its natural position, and then cemented the splint in position. I asked her to come back the next day that I might see how it was

progressing. She told me that in the evening after going home she had some pain in the jaw, but the next day there was no pain and the soreness had passed away. After she had worn the splint for about two months I took it off to ascertain the condition. The tooth was attached, but not quite strong yet. The splint was replaced, and she wore it for two months longer. It is now over nine months since the first operation, the splint is off, and has been for three months, and the tooth seems strong, though just a little loose, but not more so than hundreds of teeth that we do not consider diseased at all.

I do not say that there has been a reproduction of tissue in this case, but there appears to be a reproduction of the alveolar process, and the recession of the gum is considerably less than it was. Of course we cannot tell what its condition may be a year hence, but at present it appears to be a perfect success.

DR. ATKINSON, of New York: When a case of this kind comes to me I generally find the teeth out of line, and scarcely ever find all the teeth in the mouth.

I have a case that has been under treatment for the past three months, in the mouth of the wife of a brother of Professor Dorrance, of Ann Arbor. She had not lost any of the teeth, but the left superior lateral incisor was projecting, not a quarter of an inch, as the last speaker related, for that would be more than the length of the crown, but it projected half the length of the crown below the line of the central and cuspid. All the teeth were very loose, the gums very tumid, and there were heavy discharges from more than half the teeth above and below. My son and myself tied the teeth where I wanted them to stand before I commenced to cleanse them at all. The teeth were then trimmed with a sharp corundum wheel to so occlude that each tooth should do its part of the reception of its antagonist. The mouth was washed with simple vinegar to get rid of a very dense protoplasmic saliva, with the débris about the teeth. The teeth and gums were then dried with bibulous paper, and aromatic sulphuric acid of full strength was dropped into the pockets. The affinity of this acid for the tissues of the locality and the substances there that are in a dead and dying condition will cause it to be drunk in, so that you must keep on dropping until the pools are full above and below, and curiously enough the pools above will antagonize gravity and will suck the acid in. We now have the tissues completely saturated, and in doing this, before you begin dropping into the pockets, lay wisps of bibulous paper so as to protect the

lining of the mouth under the tongue and in the buccal chamber between the lips and the teeth. As soon as you find the acid is well drunk in you may use common bicarbonate of soda solution to wash out the mouth. It will not go into the chambers to displace the acid, where you want the latter to do its efficient work.

In this case I did not attempt to remove the calcareous deposits which were on some, but not all, of the teeth, on account of the extreme looseness of the teeth, not one of which seemed to have any bony socket around it, but rather seemed to be set in elastic gum-tissue. The next day when she called she said she had eaten comfortably for the first time for an indefinite length of time. We now attempted to cleanse the teeth. I have never yet succeeded in thoroughly cleansing such a case at one sitting, even if it continued for four hours, but I do the best I can. One point I wish to impress on you young men, and that is, never pull with a hoe to remove calcareous deposit under any circumstances, especially where the teeth are loose as these were. Use an instrument that is fluted so as to fit the size of the root, with a no-point edge; press it onto the root, and have some one who knows how, to tap the instrument. If you now find that there is a portion of the tissue that has not been cooked by the aromatic sulphuric acid, and that looks like what we used to call proud flesh, touch all such places with drops enough of the aromatic to cause it to assume that kind of grayish appearance that always follows this method of treatment. Then rinse the mouth again with soda, dry it, and take folds of bibulous paper of sufficient length to cover all the territory that is diseased, smear over this a paste of tannin and glycerin, and lay this over your pockets and send your patient away. If this is thoroughly done you will probably succeed. In cases as bad as the one I am relating you might not, however; and if the aromatic sulphuric acid does not act promptly within a week you will conclude that the adaptability of that remedy for that particular case is not satisfactory. You should then use a paste made of crystallized carbolic acid and caustic potash. The following is the method of preparing the paste: Place your bottle of carbolic acid crystals into hot water so that the crystals become melted; put your mortar into boiling water, and then rub the two ingredients together thoroughly. I do not know what the proportions are. Equal parts will not do. My impression is that it should be one and a half to two of carbolic acid to one of caustic potash. You must be very careful not to have a drop of water in it. The Robinson remedy has water in it.

After you have made a perfect paste it will soon become dry, and can then be broken into small pieces with a pair of tweezers and should be kept in a wide-mouthed bottle. In using it, apply to the most distant places first; as soon as it gets warm it will melt, and it will find its locality through the affinities of the fluids in the pockets. Having treated all the diseased territory in this manner, you will seldom have to repeat its application.

In this case, while there was no process at all about any of the teeth when she first came to me, now, after three months of treatment, I would not know that there had ever been any trouble with the teeth of the right side up to the right superior lateral incisor, the teeth are so solid and firm, though she is a very bad girl about keeping her appointments.

Keep the control of your cases. My friend from Texas would have succeeded if he had kept watch of that fellow and not let him begin to sin again.

She has eaten on both sides since the first treatment, but on the left side the bone-deposit has not yet taken place, though the tumefaction of the gums has almost entirely subsided.

This is a simple delineation of a case, and I give you the name of the individual so as to fasten it in your minds and that you may know there is a foundation for what I am saying.

Dr. Morrison, of St. Louis: Dr. Atkinson alluded to the manner in which he scaled loose teeth. I would like to make one suggestion to him for such cases, and that is to use a very delicate, long-bladed forceps, for scaling teeth in this condition, allowing one beak of the forceps to rest on the incising end of the tooth and the other to work up and down the surface of the tooth above the gum, by the opening and closing of the forceps.

Dr. Atkinson: That I have done repeatedly.

Dr. J. Taft, of Cincinnati: The first indication in these cases is to make a diagnosis, and it is well to remember what that means. It means more than a mere glance at the case and ascertaining that the gums are separated from the teeth, or that there is a deposit upon the roots, or degenerated tissue along the walls in the socket, perhaps involving the alveolar process. It means a thorough cognition of all abnormal conditions, both local and systemic, that in any respect affect the case in hand; and in addition, it is important to note whether it is a case in which nutrition is good or otherwise; whether the patient is vigorous and will well resist disease-producing influences whenever they may be manifested. When a good compre-

hension of the case is attained, then treatment is in order. In all these cases there is more or less local irritation,—the cause, in part at least, of the affection. Deposits of foreign substances between the margin of the gum and the root of the tooth; undue movement or pressure, or a blow upon a tooth; or a tooth or teeth may be overtaxed by reason of a diseased condition of other teeth; all these are sources of irritation and should be removed. The gums take on diseased conditions from various causes, among which are reckoned micro-organisms in the sockets. These no doubt have some influence, but how and in what way is yet an unsettled question. The susceptibility of the tissues to irritants must also be recognized. In the tissues of some persons irritation is easily induced, while in others it only occurs by the influence of very active irritants. All these things must be taken into account if we would intelligently treat such cases. In the first place, all local irritants must be removed, such as calcareous deposits, necrosed alveolar process, and micro-organisms destroyed by antiseptics. Of the various agents employed in the treatment of this affection, sulphuric acid is one highly prized by many. Aromatic sulphuric acid is usually employed. However, some prefer the chemically pure acid, diluted with seven parts of water,—this giving about the strength of the aromatic preparation. This, when injected into the pockets, dissolves any calcareous deposits that may be on the root, and remnants of necrosed process, and cauterizes dead or dying soft tissue, so that it will be the more readily sloughed off and a condition established favorable to the giving out of healthy plasm, from which healthy granulation may take place and the reparation of the parts.

DR. W. H. ATKINSON: I should prefer pure sulphuric acid diluted,—one of acid and seven of water,—rather than the aromatic. The latter, however, you can always rely upon, as its strength is uniform.

DR. J. TAFT: Some have said that they prefer chemically pure sulphuric acid. This is altogether a more severe escharotic than is required in any case. It is impossible to bring about a state of repair and health without removing, not only the débris of the various kinds that may be presented, but the half-dead tissue must also be removed, and this may be done by an escharotic or a solvent, or by excision. The Robinson remedy, which consists of carbolic acid and caustic potash, is an excellent solvent, and will readily dissolve dead and dying soft tissue. Chloride of zinc is also a very good escharotic, but is not as energetic as the sulphuric acid or the

Robinson remedy. It is one, however, better adapted to the milder forms of this affection than the more heroic agents. The results in the treatment of diseased gums will vary exceedingly. In some cases the disease yields very promptly to treatment, and even to mild treatment; while in others the disease is very obstinate, and in some cases seems hardly eradicable. It is not only an important point to determine the appropriate treatment for any case presented, but it is equally important to know when sufficient treatment has been employed. Doubtless in many instances unduly prolonged treatment is employed, and irremediable mischief done thereby. Would that we all knew when to cease treatment, and when to afford nature an opportunity, and the case a rest.

It is false practice to keep on dabbling with these active agents. A gentleman said to me not long since, "I have lost all faith in sulphuric acid." I asked him why; he replied, "I used it ten times in one case, and it was worse when I got through than when I began." I should think very likely.

Very rarely indeed will this escharotic or the carbolic acid and caustic potash be required more than once. I do not remember that during the last two or three years I have used either of them more than once in any given case.

Dr. Storey: I wish to say that I do all these things in the ways that the gentlemen have suggested, and I get the cures after a manner as they get them, but the constitutional disturbance is still there, and within six or twelve months the patients come back to me with teeth and gums getting back to the same condition they were in before I commenced to treat them.

Dr. Friedrichs, of New Orleans: How long does the mouth remain aseptic after the sulphuric acid is applied to destroy the organisms? And again, can you render the mouth aseptic, and keep it so?

Dr. Taft: The doctor spoke about cases that return within a year. The trouble was there was a want of thoroughness in the treatment. Every now and then the disease recurs, but does a physician ever treat a patient with a certainty that he is going to remain free from disease for the next thirty or forty years? I do not think anybody claims that.

SECTION VII.

ANATOMY, PATHOLOGY, AND SURGERY.

Chairmen of the Joint Committee, W. C. WARDLAW, of the Southern Dental Association, and TRUMAN W. BROPHY, of the American Dental Association.

REPORT BY TRUMAN W. BROPHY, OF THE AMERICAN DENTAL ASSOCIATION.

MR. PRESIDENT AND GENTLEMEN:

The Section on Anatomy, Pathology, and Surgery most respectfully submits the subjoined report:

The contribution to the Association on these subjects,—in addition to the papers on pyorrhea alveolaris and implantation, already presented,—and a review by the chairman of some of the more interesting surgical procedures of late, will be an oral report of two cases in practice by Dr. John S. Marshall.

During the last twelve months the science and art of surgery have made marked advancement, demonstrating that the possibilities of surgery cannot be foretold.

Among the operations chiefly attracting the interest of the oral surgeon is the transplantation of tissues. In the human subject, these operations have recently been carried to an extreme previously unknown, and transplantations from the lower animals to man are practiced to an extent which gives us hope of attaining results in surgery not hitherto contemplated.

At the recent Congress of German Surgeons, Wolfler, of Gratz, advocated transplantations of mucous membrane, as he regarded such operations of great value. Dr. Wolfler successfully transplanted mucous membrane from a collapsed rectum to the conjunctiva in a

blepharoplasty, and in numerous cases successfully transplanted mucous membrane from frogs, pigeons, and rabbits.

During the month of April last, Dr. C. Fenger, of Chicago, transplanted successfully mucous membrane from a rabbit to a man in blepharoplasty.

Dr. Gersung, of Vienna, assistant to Prof. Billroth, has recently performed a novel and interesting operation,—the transplantation of nerve from the rabbit to man, his patient being Prof. von Fleischl, the distinguished occupant of the chair of physiology in the University of Vienna. From a surgical stand-point, this remarkable operation has so far not only been conspicuously successful, but the function of the nerve has to a marked degree been re-established. Sufficient time, however, has not elapsed since the operation to determine whether complete sensibility will return to the fingers, the parts which were anesthetized from loss, in consequence of neuroma, of their sensory nerves. The favorable results two months after the operation indicate that a complete restoration of function may be expected.

Equally interesting in this line of surgery is the operation for the transplantation of a rabbit's cornea to the human eye. At the Eye, Ear, and Throat Department of the Presbyterian Charity Hospital, of Baltimore, Dr. Julian J. Chisholm has recently, as he announces, successfully performed this operation. The patient was a healthy man aged thirty-five. Three years previous to his admission to the hospital, he had lost the sight of both eyes from the effects of caustic lime. As a result of this accident, there was union of the eyeballs to the eyelids, or symblepharon. Sloughing of the surfaces of the conjunctiva ensued. The eyes had been operated upon, and the lids separated from the cornea, yet the cornea remained opaque, with no indication of becoming clear, and upon its surface was a thick layer of granulations. Hopelessly blind as the patient was, Dr. Chisholm performed that wonderful operation devised and introduced by Prof. von Hippel, of Geissen, Germany. The operation, performed by the use of Von Hippel's cornea trephine, consisted in the insertion of a clear piece of a rabbit's cornea into an opening made for it through the opaque human cornea. The minute details of this delicate operation I will not describe, as it is sufficient for our purposes to note the result. By use of the trephine named, the opaque cornea of the patient's eye was removed, and with the same trephine a duplicate plug of the rabbit's cornea was removed and carefully inserted in the opening made in the center of the human eye. The parts were

then dressed with compress and bandage, which completed the treatment. In a few days the graft became adherent as in skin-grafting, and a little later the sight of the patient was restored.*

Through the use of cocaine, no pain was experienced by the man, nor exhibited by the rabbit.

It is unnecessary to state that iris, pupil, lens, and retina must all be in good order that benefit be secured. This new operation will bring relief to many hitherto considered hopelessly blind.

Noting the success attending the transplanting of different tissues of the body,—skin-grafting, long known and successfully practiced; transplantation of bone, or bone-grafting; transplantation of mucous membrane from man to man and from rabbit to man; transplantation of cornea from rabbit to man,—awakens in us the hope that in the near future staphylorraphy and kindred operations may be enumerated among those surgical proceedings which, when necessary, will appropriate sufficient tissue from the lower animals to insure successful performance.

Dr. E. C. Kirk, of Philadelphia, in a classical paper on the subject of implantation of teeth, based on his experience extending over two years, during which time he performed the operation thirty times, states that all the cases were successful but three. Two of the three failures were in one mouth, the patient being affected with a specific virus. The result of these experiments leads the author to the conclusion that attachment in favorable cases is by bony anchylosis. The two points especially to be guarded are first, the selection of cases from which catarrhal conditions are absent, and second, the avoidance of all influences which tend to marked inflammatory action.

In the opinion of Dr. Kirk and others, the prognosis of these cases seems favorable, if antiseptic measures be faithfully observed and practiced during operations.

While such tissues as mucous membrane, nerves, etc., are, under antiseptic precautions, successfully transplanted, we cannot regard the conditions following such operations as analogous to the implantation of teeth.

In bone-grafting, the newly-grafted bone does not become the substitute of the part it is intended to replace, but furnishes a nucleus around which new bone is formed, and the grafted pieces are removed

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*A later report of Dr. Chisholm's cases states that the operation was not ultimately successful.

by a process of absorption. Such also is the case in skin-grafting, sponge-grafting, etc.; and our observations of implanted teeth which have failed show that absorption also of their roots has taken place. When these other substances are placed in position, immobility may be maintained,—they are not subject to external disturbances. Not so with the teeth: they are always exposed to irritants from without. If, therefore, the teeth implanted be fixed by anchylosis, their early destruction, it would seem, must in the absence of the pericemental cushion result from shock, even though absorption of their roots should not occur. As to whether implantation shall become a standard operation in oral surgery remains to be determined.

It has been demonstrated that the resection of the inferior dental nerve may be accomplished so as to avoid its redevelopment and reunion, if the segment of bone displaced to expose the nerve be returned to the opening with the periphery of the bone plug placed inward. The object of inverting the plug is to close the inferior dental canal.

While distinguished gentlemen in Europe have accomplished much and contributed largely to the fund of information in this department of our practice, the achievements of Prof. Garretson as an oral surgeon have not their equal in the annals of our professional history. His operation of removing the superior dental nerve at the foramen rotundum must take its place among the most skillful and important operations in this department of surgery.

SECTION VII.—Continued.

Cases of Supposed Dental Necrosis and Fatal Alveolar Abscess.

REMARKS BY JOHN S. MARSHALL, OF THE AMERICAN DENTAL ASSOCIATION.

I HAVE a very peculiar specimen which I wish to present. It is a left superior central incisor. Upon the labial aspect of the root, about midway between the gum line and the apex, will be discovered what appears to be a sequestrum. I had supposed that the formation of a sequestrum in dental tissue was an impossibility. I am not convinced now that it is one, but it looks very much like it.

The history of the case is this: Some two years or more ago there was a small cavity of decay at the gum line on the labial surface. The patient went to a lady dentist, who packed the cavity with cotton to force the gum back. Every time the cotton was removed the gum bled, but she kept up the packing process for two or three months, when the patient went into the hands of my friend, Dr. Brophy. He, I think, found the pulp either badly inflamed or dead, and treated it, filling the root with gutta-percha. If it were light enough you could see that the apex was perfectly filled, but there appears to be an opening on the side of the tooth as though it had been drilled through, but whether that is the fact I cannot say. When the case came into my hands the tooth was extremely loose, and discharged very profusely from the labial aspect of the gum. There seemed to be no process on the labial aspect, and after drilling in from the palatal surface of the crown, I found after taking out a portion of the gutta-percha that there was hemorrhage, and I tried for several days to stop it, but finally by probing in different directions I found the opening through the side of the tooth. I then told the patient the only thing to do was to extract the tooth, which I did.

I will ask Dr. Sudduth if he will kindly take the tooth home with him and examine and report upon it, that we may know whether it is a case of necrosis or not.

I had recently fall into my hands at Mercy Hospital, at Chicago, a fatal case of alveolar abscess. I will read the hospital report of the case. I present this because these cases are somewhat rare, and also because I wish to impress upon the minds, especially of our younger men, the folly of saying to a patient when he comes to you with an abscessed tooth and the jaws somewhat firmly closed, that you cannot do anything for him until such time as the swelling has gone down, because you cannot get his jaws open. Give him an anesthetic and open his jaws and get the tooth out.

The report of the interne of the hospital is as follows: "Peter O'Toole, single, age 25, laborer on city railroad. Diagnosis of disease, emphysematous gangrene. The patient was admitted April 26, at 11 A.M. At that time the pulse was rapid and wiry, 105; temperature, 102°; respiration, 22. Face was very badly swollen, and a peculiar crepitation manifested itself."

The swelling extended down on the neck nearly to the clavicle, and at a point on either side about an inch anterior to the angle of the jaw were incisions which had been made a few days previously. These had been made by the surgeon of the railroad, because when the patient came into his hands he discovered it was a case of emphysematous gangrene, and desired to get rid of the affection as quickly as possible. In cutting open the face at this point he was unfortunate enough on the left side to cut off the facial artery, from which followed a very severe hemorrhage. Out of this wound was constantly oozing an extremely offensive discharge. The patient in health was a strong, robust man, with a record of no previous sickness. On the right side the inferior wisdom-tooth had been undergoing a process of decay for some time, and about three weeks previous to this date had pained him, and had been very sore to the touch of the tongue or in mastication. Shortly after this an alveolar abscess had formed, and from thence the trouble extended to its present condition. The report goes on to state how the patient was handled when he first came in: "Patient's clothing changed, and he was given a sponge bath with a liberal amount of carbolic acid. On examining the openings a probe was found to pass easily in any direction for about an inch and three-fourths. These openings were thoroughly irrigated with bichloride, one in two thousand, and an iodoform dressing put on and the patient put to bed. Brandy and

quinine were prescribed in full doses, and the nurse instructed to give all the nourishing food he could take, but his tongue being so badly swollen he could not swallow solid food, and liquid food could be taken only with difficulty. At night one-fifth of a grain of morphia was administered, and he slept well. At 10 P.M. the cavities were again irrigated and dressed antiseptically. April 27, feeling fairly well. Temperature $101\frac{6}{10}°$, pulse 103. Openings irrigated thoroughly with one to two thousand solution of bichloride, and dressed antiseptically, as before. On the 28th, pulse 104, temperature 102°; patient feeling about the same as on the 27th. On the 29th, pulse 107, temperature 103°; the discharge extremely profuse at this date. April 30, pulse 103, temperature $102\frac{4}{10}°$; swallows with great difficulty, but does not complain of pain. May 1, pulse 109, temperature $102\frac{8}{10}°$; discharge extremely offensive. May 2, pulse 112, temperature 103°. Ether was administered at this time."

This was when I first saw the patient. I had him at once put on the table and etherized, and by use of the mouth-gag succeeded in getting his jaws sufficiently open so that I extracted both of the lower wisdom-teeth. Both were decayed, though only one was giving him any trouble.

"May 3, pulse 105, temperature $102\frac{4}{10}°$. Patient spent some time sitting up in his chair, and feels a little better. On the 4th, pulse 106, temperature $102\frac{5}{10}°$; has taken considerable nourishment, milk and beef-tea. On the 5th, pulse 114, temperature 101°, lower than for some time before. On the 6th, pulse 118, temperature 103°."

At this time I removed several large loose masses—which must have weighed at least four ounces—of necrotic tissue from the region of the neck under the jaw.

"On the 7th, pulse 120, temperature $102\frac{4}{10}°$; discharges very freely. On the 8th, pulse 124, temperature 103°. At 10 A.M. profuse hemorrhage on the left side where the facial artery had been severed. Patient lost about eight ounces of blood, and is very weak. Pulse immediately became weak and rapid, reaching 140. In addition to brandy and quinine, digitalis was prescribed, which decreased the number of heart-beats per minute. On May 9, pulse 112, temperature $103\frac{4}{10}°$. Patient very weak, and is looking pale and emaciated, and talks with great difficulty owing to the swelling of the tongue. On irrigating, the fluids pass into the mouth freely. Removed another very large piece of necrosed tissue from the right side. On May 10, pulse 120, temperature 104°. Patient very weak and has had bad diarrhea. Lead and opium pill was administered, which

seemed to check the diarrhea somewhat." Patient does not complain of pain, neither did he at any time after I saw him.

"On May 11, pulse 130, temperature $104\frac{2}{10}°$. At 10.40 A.M. severe hemorrhage from left side occurred again; two ounces of Monsel's solution were injected, which, in addition to pressure, stopped the hemorrhage. The bleeding was very profuse, patient losing about twenty ounces; the pulse immediately went up to 165, weak and soft. Brandy and digitalis were injected hypodermically. Shortly after the hemorrhage stopped, the patient fainted. Hypodermically administered brandy and digitalis failed to revive him. From this time till death pulse barely perceptible and very rapid and weak. He retained perfect consciousness to 7.30, at which time he died from exhaustion. At no time during his sickness in the hospital did he complain of pain."

If I did not know the surgeon who had charge of the case to be a cleanly man, I should have thought this one of those cases in which the patient had been poisoned by a filthy knife; but knowing the gentleman to be one of the best and most careful surgeons in Chicago, that inference cannot be entertained.

I believe the case to have been simply the result of an alveolar abscess which was allowed to run too long. If the dentist who saw the case at first had removed the tooth, or had properly treated the abscess, he could have saved the patient's life.

DISCUSSION.

DR. ATKINSON: I am always delighted when we have new cases come before us, but my opinion antagonizes the opinion of the surgeon who has just detailed this case, and sets the caveat clearly before us that I have so often advocated, to be careful about extracting teeth when there was necrosis of the soft parts. The sloughing on the right side I have no doubt came from the debility resulting from the extraction of that tooth; in other words it was the stepping-stone to the death of the man.

DR. CRAWFORD, of Nashville: I am satisfied that we as a profession do not appreciate the influences that affections of these teeth have in the production of troubles that lead to very serious consequences. I know an individual who was so deluded as to be seeking health-resorts in order to overcome an attack of phthisis in its primary stage, when the removal of an impacted wisdom-tooth gave prompt relief.

I am a little surprised to hear my distinguished friend across the way—whom I revere very much—intimate that he would condemn the removal of a tooth under the conditions indicated by the report of this case. The broad declaration was, that the removal of teeth from dead or necrotic tissue was condemned. If you will show me a dentist who has not removed them under such conditions, I would like to make his acquaintance. That a fresh wound made in close proximity to a septic condition might be deleterious is undoubtedly true, but from the extreme condition of this case as shown by the clinical report, I cannot see any other procedure indicated than the getting away of the offending member, and if the notes be correct the wisdom-tooth was the exciting cause.

DR. PATTERSON, of Kansas City: It seems to me the first mistake in the treatment of the case was the severing of the facial artery. That led at last to the exhaustion that caused his death. It must have been a blundering operation.

DR. SUDDUTH, of Philadelphia: I should like to call attention to the excellent character of the paper and reports on the subject of implantation.

The report by Dr. H. A. Smith is exhaustive, and notes I think the principal work that has been done in this line. I look very favorably upon the operation of implantation as it is performed at the present time, and think the dental profession deserves to be complimented for having introduced this class of operations and for having developed them intelligently and scientifically until they are in a fair way to be generally adopted.

The old operations of replanting and transplanting are well known and were justly condemned. They proved failures in almost all cases, but I should like to inquire why they were failures? The tooth in replantation was extracted because it and its surroundings were in a diseased condition. If the end was found to be roughened by absorption, it was smoothed off and the tooth replaced. It was thus reinstated in a tissue which was chronically diseased, in which the tendency was toward a retrograde movement. Everything was against the tooth becoming a healthy member. In transplanting, the operation was performed under very much the same conditions. The operation of to-day, implantation, is entirely different. A carefully selected tooth, treated antiseptically, is placed into a cavity made in healthy tissues, where the tendency is towards a healthy outcome; hence I look upon it more favorably by far than I do upon the old operations of transplantation and replantation.

The method of attachment of implanted teeth can be understood by studying, histologically, the repair of tissues in general. In implantation a wound is made in healthy tissue; by way of repair lymph is thrown out, which becomes organized into connective tissue. The original attachment of the tooth is fibrous in character, but in implantation freshly-wounded bone-tissue surrounds the root, and its tendency is to develop new bone; and if the inflammatory condition be kept at a minimum, the tooth simply acts as a stimulant, inducing the development of bone,—the particular tissue needed for repair in this case. The tooth then becomes fastened in its place, not by vital union, unless the tooth had been taken from one mouth and immediately inserted in another, but by a process of anchylosis.

The better understanding of antiseptics, whereby we can destroy the germs that would of necessity cause irritation, renders implantation at the present day much more likely to succeed than could have been the case ten or fifteen years ago.

In thirty-three cases in which Dr. Kirk operated,—covering a period of over two years—the teeth have become very firmly attached. We have not been able to make any histological examination of the successful cases, of course, but we hope to make experiments on the lower animals and to be able to present the results later. Regarding the manner of attachment, at present we can only advance the theory of anchylosis, and we base that on the immobility of the teeth and the further fact that they give a peculiar resonance when tapped that is not given off by other teeth. The pericementum which surrounds the roots of teeth serves as a cushion to soften the blow in mastication. In the case of an implanted tooth there is no such cushion, because the pericementum in nearly all cases is dead. A tooth thus solidly fixed in the jaw receives a direct shock in mastication much more severely than the other teeth, and being the weaker member, in case of the vitality of the system becoming lowered would be less able to resist and would be the first to fail.

If implanted teeth will prove serviceable for five or six years, why is not implantation a proper surgical operation, and especially justifiable in the anterior part of the mouth? The idea brought out by Dr. Brophy in his paper with reference to the nourishment of transplanted tissues, especially transplanted bone, bore directly upon this point.

Dr. W. H. Morgan: I have not performed the operation of implantation, but I greatly fear that one of these days we shall have

most serious results from the introduction of dead teeth into the animal organism.

As to the manner in which their retention is accomplished, I think that the foreign tooth is simply encysted, the tissues being thrown around it and the inequalities on the surface of the cementum furnishing the hold which retains it in its place. I do not accept the idea that anchylosis occurs. My understanding of anchylosis is, that it is a union of living parts, which could not take place in cases of this kind. These implanted teeth are merely tolerated while the surrounding tissues retain their healthy condition, but in the course of time an unhealthy condition is set up, and then nature goes to work to pull down the surroundings so as to let the offending matter out, as she would a splinter from your hand. I have seen many cases where steel has been projected into the hands of men who make mill-stones, which was sealed up there and gave no trouble. But in implantation the foreign bodies do ultimately give trouble, and we are justified in supposing that every case will result in ultimate failure.

One word about the wisdom-teeth. I am sure that we do not give them sufficient attention in our examination of the mouth. There are but few cases in which any large overlapping of the gum on the posterior or on the labial surface of the tooth is observed, where there is not more or less disease that demands attention. Sometimes the disease progresses in one direction and sometimes in another. Occasionally a discharge will drop down into the throat and give rise to serious trouble, destroying a portion of the mucous membrane. I saw and treated a case some years ago where a large abscess had formed. I was invited by the gentleman in charge to see the case after it had been progressing for ten or fifteen days, and found the jaw very much enlarged, the swelling extending down nearly to the clavicle and up quite to the temple. Careful examination satisfied me there was a large amount of fluid there that should be discharged. An incision was made just in front of the angle of the jaw, and a great quantity of matter was discharged which was very offensive. I then syringed out the cavity with tepid water, when we observed something protruding from the opening, and the surgeon said, "That is the cartilage which lined the glenoid cavity." We expected after that at least an anchylosed joint to result; but the constant care bestowed upon the case in washing out the cavity first with tepid water and then with iodine and water, secured a more favorable outcome, and in the course of three months the patient was out on the street, and there was no anchy-

losis. This trouble arose from the roots of the wisdom-tooth and an attempted extraction of them.

DR. FRIEDRICHS: The roots were not extracted?

DR. MORGAN: I never saw them.

DR. CATCHING, of Atlanta: I am glad to hear the gentleman say that an implanted tooth is held by anchylosis. In the process on which I am working I expect it to be held by gomphosis. I am experimenting by implanting porcelain teeth. I am not quite ready yet to report, but I am getting along very well.

DR. MARSHALL: I never knew our Father Atkinson to listen so poorly as he did to-night. He must have been thinking of something else when I read the notes of that case, because he charges that the extraction of the teeth in all probability had as much to do with causing the man's death as anything else. If the doctor had listened carefully he would have observed that after the extraction of the teeth the man continued to improve up to the time when the ligature on the facial artery sloughed off, when there was a severe hemorrhage and he had a sinking spell. He was revived from that and progressed another two days, when he had another tremendous hemorrhage and died.

DR. ATKINSON: I understood you perfectly. How does your explanation militate against what I said? Have you given any argument to weaken my conclusion?

DR. MARSHALL: I understood you to say that the patient in all probability died from the extraction of the teeth.

DR. ATKINSON: I said that that was a better conclusion than the one you had made yourself, because the disease was emphysematous necrosis when it started. What is emphysematous necrosis? It certainly is not necrosis of bone; it is necrosis of soft tissue. What constitutes crepitation?

DR. MARSHALL: Fluid.

DR. ATKINSON: What kind? Gases are fluids, to be sure. Do you mean fluid or liquid?

DR. MARSHALL: Liquid.

DR. ATKINSON: I thought you meant liquid. Not at all. Liquids do not behave in that way. You do not get crepitation from palpation of liquids; it must be of gases. It is the disintegration of the molecules of the tissues that are not properly organized, by reason of the introduction of something that sets up the ferment that splits the molecules, setting free either hydrogen and oxygen or sulphur and oxygen or sulphur and hydrogen. Some of these gases are set

free within the tissues as original elements, and that makes crepitation.

DR. MARSHALL: Do you mean to say that if the hemorrhage had not occurred in this case the patient would have died?

DR. ATKINSON: I do not. Now, listen, if you are pathologist enough to understand; and if you are not I will make you so. You said that this bad-smelling material was taken away—four ounces.

DR. MARSHALL: I said I did not weigh it.

DR. ATKINSON: I am willing to take it at that. How came that side to be sloughing off?

DR. MARSHALL: By extension of the disease.

DR. ATKINSON: How did it extend?

DR. MARSHALL: By burrowing.

DR. ATKINSON: I beg your pardon, unless you call carrying the forceps from one place to the other a "burrowing" process.

DR. MARSHALL: The swelling was on both sides of the face before I saw the man, and both sides had been opened up with the knife before I saw him. That was all plainly stated, which you would have known if you had listened attentively.

DR. ATKINSON: I will convince you that what I did say I was justified in saying. It was my earnest advice to my brethren to be cautious about extracting teeth when there was a necrotic condition of the soft tissues.

DR. STOCKTON: Would you have let the tooth remain?

DR. ATKINSON: For the time being, most assuredly, if the jaw was shut so tightly that it had to be opened under the influence of that "devil's first lieutenant," anesthesia.

DR. MARSHALL: I have made all the point that I wish to make, to show that the man died from hemorrhage.

DR. BROPHY, of Chicago: As to the case that was related by Dr. Marshall in connection with the specimen he shows of apparent necrosis, the patient was once under my charge. The root was opened and filled, the trouble in the first place having been an exposed pulp, which was destroyed. There was no attempt made to drill the root, so that the opening in the side could not have been caused by that means. It is my opinion that the disease which caused this trouble had existed before any treatment was begun, and that there was pericementitis before the pulp was destroyed. I do not attempt to account for the condition that has been exhibited to you all.

DR. MARSHALL: Do you know how long the case had been in the hands of the lady dentist before the patient came to you?

DR. BROPHY: I have no definite knowledge in regard to that, but my impression is that it was a long time.

In regard to the hospital case reported by Dr. Marshall, I do not think it has been proved that the tooth was the origin of the disease, but in any event it would seem to me that at the time the patient was placed in Dr. Marshall's hands the removal of the tooth upon the side that was not first affected, and which had not been abscessed, was scarcely justifiable, for the reason that the tissues were extensively breaking down and were gangrenous, and by the removal of the tooth on that side there would be danger of septicemia resulting.

I do not say that the extraction led directly to the death of the patient, but I think that such proceedings under such circumstances had better not be practiced. No doubt the death of the patient was directly due to general debility resulting from the loss of blood —as there was recurrent hemorrhage on two occasions—and to septicemia.

A word about the implantation of teeth. I am not a very ardent advocate of that practice. I hope it may be successful, but, as I stated in my paper, if the tooth is fixed by anchylosis and becomes firmly attached in the maxillary bones, it may break down very soon as a result of mechanical shock. The object of the pericementum, aside from the physiological function that it has to perform, is to prevent this shock by furnishing a cushion which will allow the tooth to move slightly when anything comes forcibly in contact with it. If it is fixed by anchylosis its life, in my opinion, must necessarily be very short.

DR. MARSHALL: I wish to say in reply to Dr. Brophy's criticism of the removal of the tooth upon the left side of the jaw, that from the time of its removal the patient began to mend. Before its extraction he was confined to his bed; after it he was able to sit up all the time, and he probably would have recovered but for the hemorrhage caused by the sloughing away of the ligature on the facial artery.

DR. ATKINSON: It is not always best to use peroxide of hydrogen if you care for the comfort of your patient. I wish to emphasize this: that you must be careful that you get a good quality of peroxide of hydrogen, for it will degenerate very rapidly. The combining grip of the extra equivalent of oxygen is so slight that any-

thing above sixty-five degrees Fahrenheit will allow it to disassociate itself from the water and leave H_2O. That gas moves, like every other body, in the line of least resistance, and if there be something that has a strong affinity for oxygen, it will percolate very speedily.

I have seen the cavities of multilocular abscesses after treatment with peroxide of hydrogen distended, bloodless,—entirely white all along the gum,—and deny the penetration of any diagnostician to predetermine that condition. I would advise care and a washing out of the cavity that holds the débris, whether it be pus, sanies, or ichor. First clean that out (if an open cavity, with dry bibulous paper) before using the peroxide.

The first thing to use after washing with warm salt and water is a solution of carbonate of soda,—washing soda,—which makes soap of the remaining débris. Then dry and use peroxide of hydrogen with a considerable degree of comfort, to yourselves at least, and I hope that you will not agonize your patient more than is necessary. After the bubbles cease to appear, use bibulous paper or some other means of drying, and then put in your disinfectant, whatever that may be. I think I have said enough to awaken you to give attention to these very fine and basal principles that are so generally ignored.

DR. BEACH, of Clarksville, Tenn.: It has been asserted by gentlemen on the floor, that it is possible that implanted teeth are held in position by anchylosis.

I cannot see how there can be any connection between a dead bone and a living one. Without the membrane on the roots of the dead tooth becomes alive, we cannot account for anchylosis. There may be a provisional callus thrown out from the live periosteum of the alveolar process by which an incasement is formed around the dead tooth to hold it in position, but as to there being any union with the dead bone I conceive it to be an impossibility. No living animal tissue ever forms a union with dead matter.

DR. MARSHALL: It requires no courage to present a successful case, but it does require a little courage to stand before an audience like this and relate a failure, and I do not think that some of the gentlemen have taken that into consideration.

THE PRESIDENT (DR. CATCHING): The Chair is of the opinion that if we had more failures reported, we should be better off.

DR. ABBOTT, of New York: I desire to call attention to the method of retention of implanted teeth.

The tooth is not held by gomphosis nor by anchylosis. There is

no fusion of the tissues. A socket is dug out in the alveolar process. deep enough to deposit all the root of the tooth. When the tooth is put in, in many instances it requires considerable force to carry it home.

The inflammation produced in the bone by the operation is such as to cause granulations to be thrown out, and the root of the tooth on its surface becomes dissolved out in spots by a process that goes on through a melting down under inflammatory conditions. The granulations adapt themselves to the inequalities or depressions made in the root, and the tooth is thus held in place.

If the root has not been fitted tightly in its new socket, micro-organisms are liable to develop in the pockets left there; or if there is any pericementum left on the root it undergoes putrefactive decomposition. These are some of the causes of the destruction of the attachment.

DR. W. H. MORGAN: I understood Dr. Abbott to say that the dissolving out of the cementum was due to inflammation. Does inflammation ever occur in dead tissue?

DR. ABBOTT: It occurs all around it.

DR. MORGAN: You did not differentiate. Does inflammation dissolve anything?

DR. ABBOTT: It changes living tissue very much.

DR. MORGAN: It changes tissue while it is in an inflamed condition, but inflammation, if I understand it, is not a dissolving of the parts. But then the term inflammation is used in connection with the reproduction of tissue, and I question whether the latter is correct. Is it not an irritated condition of the parts that is benign, and that causes reproduction, and does not deserve the name of inflammation at all?

I have no doubt about the tooth being held in place exactly as Dr. Abbott describes; I have held this view since the first time I looked into the subject.

DR. ABBOTT: The first process towards inflammation is irritation. Where irritation ceases and inflammation begins, I think no one is capable of determining, any more than where any physiological condition commences to be a pathological one.

DR. H. A. SMITH: In making up my report I should have mentioned that several gentlemen called attention to this point of Dr. Abbott's with reference to the force frequently employed to place a cion tooth in position. If you drive a tooth into a socket forcibly, you may induce a high grade of inflammation and bring about

retrograde metamorphosis and destruction of tissue. Hence the advice that the tooth should accurately fit the socket and not be forcibly driven in, else you will defeat the very object sought, the reproduction of tissue around the tooth.

DR. SUDDUTH: I would like to ask, if this attachment is fibrous, how it is that in successful cases we have the tooth perfectly immovable and giving off a sharp resonant sound upon tapping, the same as if you had tapped a body firmly attached in a hard substance?

DR. PEABODY: I would like to ask Dr. Abbott whether the same process would go on if the root was a perfect cone. Is not the tooth held in by the impingement of the alveolar process, by the reproduced process adapting itself to the inequalities of the root?

DR. ABBOTT: I have no doubt it is.

DR. PEABODY: Would a perfectly cone-shaped tooth be held in in the same way?

DR. ABBOTT: I think not.

DR. CATCHING: I hold precisely with Dr. Sudduth that in many cases there is anchylosis. Dr. Chisholm, of Alabama, implanted a tooth, and for some reason it seemed desirable that it should be extracted, and it was impossible for him to remove it. He had to nip it off and leave it firmly attached to the alveolar process.

DR. TAFT: I am not quite satisfied with the statement made by Professor Abbott, that there can be a union of living with dead tissue; but there is this to be noted, that the tooth replanted or implanted is structurally like the original. It is thus far prepared for union. It is said that the implanted tooth is dead tissue. The results of sponge-grafting ought to throw a little light on this. A sponge is placed in a properly prepared cavity, and plasm is thrown into that; organization takes place in the interstices of the sponge, and a filling up with organic material takes place. The sponge was not living tissue any more than is the cementum of a tooth placed in an artificial socket. I apprehend that the organic material of the cement as there presented is ready to receive the plasm thrown out from the walls of the socket, and that an actual union takes place. I can readily conceive that there may be calcareous material thrown into this new territory and union accomplished, as we have some evidence at least,—upon the cement. Upon no other hypothesis, as it seems to me, can the case of Dr. Chisholm, or the facts referred to by Dr. Sudduth, be explained. It simply needs a little further demonstration to prove the actual facts, and I trust we shall have that ere long.

SECTION I.

PROSTHETIC DENTISTRY, METALLURGY, AND CHEMISTRY.

Chairmen of Joint Committee, J. ROLLO KNAPP, of the American Dental Association, and T. S. WATERS, of the Southern Dental Association.

REPORT BY J. ROLLO KNAPP, OF THE AMERICAN DENTAL ASSOCIATION.

HAVING Prosthetic Dentistry, Metallurgy, and Chemistry for its range, your Committee is impressed with the vast extent and the great importance of the field which it is called on to survey. It is therefore no small relief that it is principally to the labors of the past year in these directions that it is expected to devote attention.

In surveying the ground, the Committee beholds spread out before it a veritable *embarras de richesse*. It is scarcely practicable, and the Committee concludes that you would not deem it desirable, to present even a partial list of all it finds to have been suggested, attempted, or effected since the last meeting of this Association. There have appeared new books, new editions, reports, communications, reviews, criticisms, and suggestions too numerous for specification on this occasion, and relating to each branch of the profession of dentistry, including those assigned to this Committee.

With the great majority of these the members of the Association have doubtless informed themselves, especially so far as the productions bear upon peculiarities of practice, circumstances, views, experiences, and opinions.

The comprehensive "American System of Dentistry" has been concluded, and is universally acknowledged to be an honor to the country as well as to the profession, and stands as a monument to the genius,

erudition, and devoted labor of American dentists. It is, however, so well known that it is unnecessary to here enter into any particulars concerning it.

There are several other books within its scope which your Committee takes pleasure in commending as worthy of the very highest consideration. Such is the excellent work of Dr. Clifford Mitchell, of Harvard, "The Dentist's Manual of Special Chemistry." Such, too, your Committee considers "The Student's Manual and Hand-Book for the Dental Laboratory," by Dr. L. P. Haskell, of the Northwestern University.

Valuable additions to dental literature are Dr. Guilford's and Dr. Buxton's works on "Anæsthetics." A second edition of Essig's "Manual on Dental Metallurgy" is a welcome proof of the appreciation in which the original work was held, and advantage is to be expected from the revised edition. The standard work of Dr. Joseph Richardson, "A Practical Treatise on Mechanical Dentistry," has appeared in a fourth edition, revised, enlarged, and really so greatly improved that it demands the highest recognition.

For those versed in the French language, your Committee feels called upon to say that the "Traité de Prothèse Buccale et de Mécanique Dentaire," by Dr. Andrieu, of Paris, will be found interesting and instructive on its special subjects.

Many other productions, your Committee feels justified in saying, dentists could not but profit by studying.

Your Committee is profoundly impressed with the conviction that it does not exaggerate the progress which dentistry has made, is still making, and promises to make. It would impress upon all that it is not the part of wisdom to expect too much at once. Really great results are generally reached only by slow degrees and by persistent effort. There are questions now being canvassed by the profession which forcibly exemplify this fact, and your Committee expects the discussions at this meeting will still further enforce it. To invite these, as well as to illustrate its position, your Committee suggests a careful consideration of the dental uses of aluminum. In 1807 Sir Humphry Davy, if he did not procure the metal itself, proved its existence and formed alloys with it. Guyton de Morveau, Gay Lussac, Berzelius, Oersted, and other eminent chemists endeavored after him to isolate aluminum, but it was not until 1826 or 1827 that Oersted accomplished the object. In 1828, Wöhler so much improved upon Oersted's process that he is now frequently spoken of as the discoverer of aluminum, but it was

not until 1846 that he really accomplished that for which he enjoys credit. This is much; but with all effected up to 1851, Mr. Charles Knight, in his "Cyclopædia of the Industry of All Nations," said of the metal, "It is prepared with too great difficulty to be useful in the arts in its separate state." In 1854, St. Claire Deville improved on Wöhler's method, following Oersted very closely, and Louis Napoleon, who had assisted Deville in the expense of his experiments, was presented with two bars of the metal. In 1855, Rose announced yet further improvements. Louis Napoleon shortly afterwards ordered the eagles of the French army standard to be made of aluminum instead of silver, and presented a bar of the metal to the Royal Polytechnic Institution of London. Manufacturers of the metal began to spring up in various places, and when, in 1856, Deville went to England, he found the price reduced to about ninety cents an ounce. It is said to be about half the price of silver at present, and to be likely soon to compete with iron.

To attain this result has required some eighty years of earnest, enterprising, scientific effort. The steps to it have been very gradual; the obstacles have been numerous. If so much has been done, however, not all that dentistry needs and seeks has been done. One or two important points with regard to its complete availability in the profession must be held to be yet *sub judice*. One difficulty is as to its contractility in cooling; another is its liability to attack by certain agents. The enthusiasm of Dr. A. H. Forbes, of Ithaca, N. Y., exemplified in his contribution to the "American System of Dentistry," vol. ii, p. 725, would create the impression that the metal is "perfectly unoxidizable," and is only acted upon by certain well-known agents, or by "boiling solutions of potassium or sodium hydrate," while a little farther on he says, "Salt will destroy aluminum in a few hours." Richardson, in his latest edition, repeats the declaration of Figuier, reported by Secretary Foster of the Society of Arts, London, that "common salt and acetic acid (vinegar), especially when mixed, attack and dissolve aluminum," adding that this as mixed for a salad "made in a spoon of aluminum, feebly but inevitably attacks it." Essig, in his latest edition, says of aluminum, "The readiness, however, with which it is attacked by alkaline solutions renders it unfit for use in the construction of a permanent artificial denture." Similar is the tone of all general teaching on the subject.

More might be urged in this connection, but your Committee believes it has said enough for the purpose of this report, which is simply to invite discussion and investigation by the Association.

Your Committee calls the attention of the Association to a somewhat similar uncertainty respecting the use of cocaine. The *Erythroxylon coca*, from which it is procured, has been known and used widely and advantageously from time immemorial. Among its investigators, Dr. Niemann gave the alkaloid the name by which it at present passes. Many other substances besides cocaine have been discovered in the leaves, and among them one named hygrine by Lossen, though first observed by Maclagan. Your Committee has no hesitation in pronouncing that the reported experiences with cocaine, both in this country and Great Britain, justify it in insisting upon the greatest care in the use of cocaine as a local anesthetic. The frankness and courage with which unfavorable results have been reported as following its employment are highly creditable to the practitioners who made such reports.

In illustration of the caution advised, your Committee refers to the report of the proceedings at the meeting of the Odontological Society of Great Britain, November, 1887, and published in the *British Journal of Dental Science* of December 15, 1887, p. 1159, January 1, 1888, p. 9, and January 15, 1888, p. 53. This report will be found to afford full grounds for the position taken by your Committee, and gives a variety of important suggestions as to the chemical constitution of the alkaloid as found in the market, particularly as affected by hygrine, and possibly other disturbing constituents. Whatever may be the agent, whether the pure alkaloid or some other adventitious adjunct, Ott, as reported in the fifteenth edition of the United States Dispensatory, p. 564, suggests what kind of ill effects may be expected where the drug acts unfavorably. He says, "It tetanizes frogs, or in overwhelming doses paralyzes the sensory nerves and posterior columns. Rabbits and dogs are killed by it through paralysis of the respiratory centers." Abundance of cause for caution will be found in the numerous cases which have been reported, and your Committee feels it a duty to point out these facts for attention and examination.

A gratifying proof of professional advancement is afforded in the matter of crown- and bridge-work. Your Committee does not judge it necessary or advisable to swell this report with historical or descriptive particulars of that class of work, but it takes pleasure in recording the fact, doubtless already well known to many, that American methods, American practitioners, and American success have won most pronounced admiration in England. An article in the *British Journal of Dental Science*, of June 15, 1888, p. 568, speaks

in the most eulogistic terms of the success which American dentistry is everywhere achieving, coupled with the significant remark, "We do not see why our English practitioners should not earn as good fees for bridge-work as the American practitioners in London are actually doing." In this connection, your Committee takes great pleasure in calling attention to the splendid presentation of the subject in a volume just published by The S. S. White Dental Manufacturing Company, by Dr. George Evans, entitled "Artificial Crown- and Bridge-Work." An immense amount of practical and illustrated information is there given, which cannot but be of great value in the education of those ambitious to excel in this branch of practice.

Your Committee has at command a list of periodical and other publications which would suggest an extension of their report to an indefinite length; but enough has been advanced to support the claim that American dentistry has accomplished most creditable results in the past, and promises well for the future.

SECTION I.—Continued.

Rubber and How to Use It.

PAPER BY D. GENESE, OF THE SOUTHERN DENTAL ASSOCIATION.

WE are not justified in condemning rubber, as has been the case in many instances, because it has been proved to cause sore mouths. But to remove the cause and to teach the young students how to use this most useful material so as to obtain the best results, we must take into consideration the immense benefit conferred on the community by this useful and inexpensive material, and, as is evident, many years must elapse before we find a substitute for it. It but remains our duty, as long as dentures of rubber are in use, to make that class of work in the best way known to us.

I have seen rubber sore mouths, and I have seen sore mouths from every material used by us. It only requires perfect work from the modeling to the finished plate, and any material will do good service.

I have replaced gold and even continuous-gum by a rubber plate, with comfort to the patient, and no doubt we have seen rubber plates doing good service after many years.

What is the cause of the failure in them, and what will give us success?

Failure will result from rubber that has come in contact with oily substances before or during the process of vulcanizing, leaving a soft, spongy plate instead of the dense, horn-like rubber. No heat will dispel the mischief, and the plate will have an affinity for all greasy matter. This will soon decompose, and rubber sore mouth will be the result. This is no fault of the rubber.

Modeling has much to do with rubber failures. Only the finest plaster should be used, and this should have every attention in mixing.

Do not mix water with plaster, but let the plaster be dropped into the water a little at the time. When a sufficiency is so treated, allow every particle to settle to the bottom, and when every trace of air is gone, pour off the excess of water and a creamy semi-fluid will remain, easy flowing and without air-bubbles,—no excess of water and no plaster devoid of its water of crystallization, thereby making defects in models that prove pits to break into when the rubber is pressed.

Models should not be dried except in warm air, nor used until two days after the casting.

We now have to consider flasking. Small flasks are to be condemned. They should allow of a good-sized model to be placed into them without making it too thin, thus causing it to break in packing or screwing up, and consequently deranging the work.

Scalding out wax is our most important work in rubber cases. Many failures, both in plates and from loose teeth on rubber plates, are attributable to oily wax and paraffine being left in the molds or upon the pins and backs of teeth.

Only steam at high pressure can be relied upon to displace this enemy to vulcanite.

Our next treatment is keeping the molds hot for facilitating placing the rubber into them and around the teeth; and last, but not least, preparing and heating the rubber for packing.

It is a well-known fact that heated rubber will stick to hot metal. Therefore, if we have our models coated with tin foil and heated, rubber can be packed directly into place and kept there, but while the heat of the flask may be above 220°, rubber is best packed only at about 200°. I have apparatus [shown to the meeting] to control heat on rubber and models.

If rubber is allowed to be in contact with dry heated air, as in placing it in an oven, it has already begun to take the form of vulcanite, and the particles will not adhere readily, while the resistance of the hardened surface to pressure is frequently the cause of fractured models.

Again, in deep-bite sets, rubber laid in in pieces and only adhering at the edges will not be pressed into a solid form, as the air shut in will expand and often burst all the plaster casings, shrinkage taking place in ratio, and the workman will wonder what caused the results.

Gentlemen, while rubber is about the commonest material used in dentistry, nothing claims greater attention at our hands in working out the details to make it a success for dental plates. Like its proto-

type in office use, amalgam, we cannot exclude it, therefore it is our duty to give it the best treatment possible.

Here are two pieces of work for comparison, a set mounted on gold and a vulcanite one; the gold has only been used a year, while the vulcanite was worn eight, and I think you will agree with me that the inferior material is the best.

While I do not advocate cheap material, or cheap work, I seriously submit to you all the importance of using our old-time, much-abused material in the best practical manner at our command.

DISCUSSION.

DR. STOREY: The paper of Dr. Knapp with reference to the use of cocaine reminded me of something that happened just before I left home. In using some of it as a spray in a gentleman's throat, a little was spilled on the floor. This occurred at night. We have plenty of rats in Texas, and the next morning three dead rats were found near there. To determine whether it was the cocaine that killed the rats, a four per cent. solution was placed where they could get at it, and lying immediately where it was put were four dead rats the next morning. It will kill folks too as it will kill rats. We have had some ugly cases of cocaine-poisoning in Dallas.

I am going to take a final farewell. I have known for a long time through the journals and through the papers that the essayists of this meeting were very learned men. But I did not know how learned they were until this morning, and I did not know that they could get all they knew into one paper; and another thing, I did not know until this morning how little judgment they could display in pouring out all they did know in one single paper. I would like to make this suggestion, that hereafter our papers shall be short and sweet so as not to weary the audience. I was so full when I went to dinner to-day that I could hardly eat. A good paper is a good thing, but too much of a good thing is too much of a good thing, and I dare say there is hardly one of you, even the essayists themselves, who will not bear me out in the assertion that the papers were too long, and they thought so themselves before they were through reading. Let me say to the two Associations in joint session assembled, Texas bids you a final farewell.

DR. FRIEDRICHS: I have been on the lookout for these symptoms that have been reported as occurring from the toxic action of cocaine. I have been using it in my practice, by injection, for the last two

years. My son has a clinic in the Charity Hospital, where they extract no less than from fifteen to twenty and sometimes as high as forty and fifty teeth at a clinic. But neither in my son's practice nor in my own have there ever any symptoms of the toxic action of cocaine presented themselves. The nearest that I ever came to it was in the case of a lady who complained of a choking sensation after its use, and that she had palpitation of the heart; but in tracing the history of this patient I found that she was hysterical, and you all know that with hysterical patients you may have such symptoms if you simply inject a drop of water. I use a four per cent. solution, and it is only necessary to pass the needle through the gum. As it is absorbed you will find it drives the blood away and the spot becomes white until it spreads over the surface of the gum about the tooth that you desire to extract. Both sides require the same treatment, after which you should wait about three minutes before operating. Three out of four of my patients say it does not hurt at all, and the others say, "Well, I think it hurts, but still I think if it had not been for the cocaine it would have hurt a great deal more." I do not think there was a fatal case recorded in the *British Journal*, when cocaine was applied for the extraction of teeth. The worst symptoms would pass away, and the longest continuance of bad symptoms that I remember occupied the space of two hours.

DR. SUDDUTH: When cocaine was first brought out I was assistant in a surgical clinic at Philadelphia, and we had quite an extended experience in its use. It was used in strengths varying from four to fifty per cent. We had none of the bad experiences that we have heard about from other quarters. I have followed the history of this drug very closely since that time, and have come to the conclusion that cocaine is like a great many other drugs that we use. In certain cases idiosyncrasies render it unsafe, but as a rule I think it is as safe as any local anesthetic that we have ever used.

SECTION II.

DENTAL EDUCATION, LITERATURE, AND NOMENCLATURE.

Chairmen of the Joint Committee, J. TAFT, of the Southern Dental Association, and W. H ATKINSON, of the American Dental Association.

PAPER BY LOUIS OTTOFY, SECRETARY OF SECTION II OF THE AMERICAN DENTAL ASSOCIATION.

THE Section on Dental Education, Literature, and Nomenclature begs leave to submit the following as its annual report:

PART I.—*Dental Education.*

Reference was made last year to the existence of a pronounced desire among the dental educators of our country to elevate the art and science of dentistry by means of better education. The Section notes with considerable pride the advances made during the past year in many of the schools, by raising their standards of requirements for admission and graduation, as also in the generally improved tone of their methods of teaching.

We can, from study and careful inquiry, assert that at no time in the past were there so many good schools in operation as at present.

The number of schools devoted to the special education of dentists has increased from twenty-eight to thirty. The consolidation of two of these reduces the number of dental colleges now in active operation in the United States to twenty-nine. The schools are located in fifteen States and the District of Columbia as follows:

California	1	Michigan	1
Georgia	1	Minnesota	1
Illinois	4	Missouri	3
Indiana	1	New York	1
Iowa	1	Ohio	1
Kentucky	1	Pennsylvania	3
Maryland	2	Tennessee	3
Massachusetts	2	District of Columbia	3

No.	LOCATION. State.	No. of Schools.	City.	NAME.
1	California	1	San Francisco.	College of Dentistry, University of California
2	Georgia	1	Atlanta	Dental Department, Southern Medical College
3	Illinois	4	Chicago	American College of Dental Surgery
4			Chicago	Chicago College of Dental Surgery
5			Chicago	Northwestern College of Dental Surgery, Department of Dental
6			Chicago	University Dental College, Dental Department of Northwestern
7	Indiana	1	Indianapolis	Indiana Dental College
8	Iowa	1	Iowa City	Dental Department, State University of Iowa
9	Kentucky	1	Louisville	Louisville College of Dentistry, Dental Department of Central U
10	Maryland	2	Baltimore	Baltimore College of Dental Surgery
11			Baltimore	University of Maryland, Dental Department
12	Massachusetts	2	Boston	Boston Dental College
13			Boston	Harvard University, Dental Department
14	Michigan	1	Ann Arbor	College of Dental Surgery, University of Michigan
15	Minnesota	1	Minneapolis	College of Dentistry, Department of Medicine of the University
16	Missouri	3	St. Louis	Dental Department, St. Louis College of Physicians and Surgeon
17			Kansas City	Kansas City Dental College
18			St. Louis	Missouri Dental College
19	New York	1	New York	New York College of Dentistry, University of the State of New
20	Ohio	1	Cincinnati	Ohio College of Dental Surgery, Department of Dentistry, Univ
21	Pennsylvania	3	Philadelphia	Pennsylvania College of Dental Surgery
22			Philadelphia	Philadelphia Dental College and Hospital of Oral Surgery
23			Philadelphia	University of Pennsylvania, Dental Department
24	Tennessee	3	Nashville	Dental Department, University of Tennessee
25			Nashville	School of Dentistry, Meharry Medical Department, Central Ten
26			Nashville	Vanderbilt University, Department of Dentistry
27	District of Columbia	3	Washington	Dental Department, Columbian University
28			Washington	Dental Department, National University
29			Washington	Howard University, Dental Department.

a, Commencement held in the fall of the expiring year. *b*, New school. *c*, Four *honorary* degrees. *d*, Two *hon*

ANNOUNCEMENT HAS BEEN MADE OF THE ESTABLISHMENT OF THE COLLEGE OF DENTAL SURGERY OF THE UNIVER

The table appended herewith contains a correct list of dental colleges, the addresses of their deans or executive officers, and other information relating to them. From this table we learn that at the twenty-nine schools in active operation there were matriculated for the term of 1887–8, 1937 students, an increase of 299 over the number of students in 1886–7; and at the commencements held since the last meeting of this Association, 746 persons were graduated from the dental colleges of the United States, an increase of 138 over the preceding year, and making a total of 1846 graduates for the last three years (1886–7–8).

In the last annual report it was stated that of the existing twenty-eight schools only twenty-five made attendance upon two full courses of lectures prior to graduation obligatory, and hence it was possible for persons who had devoted but one year to the study of dentistry to enter the ranks of the profession. At the present time all dental colleges (whether members of the National Association of Dental Faculties or not) require attendance upon two full courses of lectures before graduation. In eleven of the colleges it is necessary that the student should be engaged in the study of dentistry not less than three years prior to graduation, while there are still eighteen colleges which will confer a degree on students who have attended two "regular sessions" at a dental school, without reference to the period of time which the student has actually devoted to the study of dentistry.

The demand for better-educated dentists is imperative, and we hope that the schools which do not yet require the student to devote three years to study before graduation will vie with one another as to which shall be the first to accede to the demand. The dental societies of Illinois, Maine, New Jersey, Massachusetts, and Connecticut (Valley) have adopted resolutions during the past year favoring the increase of the time a student should devote to study. Some schools have done even more than this. Three of the twenty-nine colleges require attendance on three full courses of lectures before graduation.

It is quite desirable that the length of the sessions in the various colleges be made uniform. At present the length of the term ranges from thirty-nine weeks to twenty weeks, and the average is twenty-six weeks. Inquiry among the schools last year elicited the fact that a good deal of opposition existed to a resolution requesting the increase of the school year to nine months. It was claimed by the schools whose terms are from four to six months that the hours

devoted to teaching in these schools equal those in the nine months' course of others.

It was difficult to ascertain the exact amount of time devoted to lectures and clinics in each of the schools. The methods of arranging the courses of study differ as much as the length of the terms. Many of the schools having a regular session of four to six months are in reality open during nine months, or even throughout the entire year. Some of these schools have a fall session, first term, or primary session, commencing about September 10, and this session is immediately followed by the regular session, second term, or winter session, beginning about October 1, and continuing until February or March, being in turn immediately followed by a third term or spring session which terminates usually about June 20, making a scholastic year of nine months. The fall and spring sessions differ from the regular or winter session by the attendance being optional, by the less number of lectures delivered, and by increase in the amount of time devoted to practical work. If the student will only take advantage of the opportunities offered to him by most of the schools, he may be kept occupied throughout the entire year.

The Section would recommend as a preliminary step to the further and inevitable course which all the dental schools will be obliged to pursue (viz: the adoption of three full sessions of nine months each), that for the present the colleges increase the course of study to seven months, from September 1 to March 30 each year, and that the regular or long session be followed by a short session extending to May 30; attendance at the short session to be compulsory to juniors and optional to seniors.

Realizing the benefit derived by the American dental colleges from the association of their faculties, the Section would heartily recommend that all dental colleges in the United States avail themselves of the benefits derived from membership therein, for the purpose of mutually aiding the development of our educational system.

Attention was called in the last report of this Section to the fostering influences surrounding a dental college which is connected with, and is a department of, some well-established and recognized medical college or university. It was said that "in the selection of such connection, State or national institutions should be the only ones considered. Sectarianism ought to be held aloof from the education of dentists; hence the union of dental colleges with sec-

tarian institutions, with the object of securing the patronage and respect conferred by the name, are deleterious to dental education." We regret that there are colleges whose connection with other institutions is merely for the purpose mentioned, of which connection the sole and only objects and advantages are those referred to. Of the twenty-nine colleges now in existence seven are independent, four are connected with medical colleges only, and eighteen are independent departments (or departments in conjunction with medical departments) of universities. Of all these, however, only eleven are connected with institutions calculated to make them more useful.

The traffic in dental degrees of any kind is completely eradicated, and the granting of degrees *honoris causa* occurs seldom, while degrees *in absentia* are now never granted. Rumors have been heard during the past year as to the granting of degrees by certain American institutions to foreigners, who, it is alleged, were not qualified to receive them. The Secretary of the Section has endeavored to obtain facts and figures relating to these cases of alleged irregularities. Nothing positive could be learned from the reliable foreign sources addressed, and while believing that the strict surveillance over foreign students now exercised and recently partly demanded by resolution of the National Association of Dental Faculties of its members, was formerly insufficient, we are confident that no cases of irregularity have occurred for several years. Some idea of the extent of injury and loss of prestige caused by the past laxity of dental schools in graduating unqualified persons may be gleaned from the following extracts from a letter from Germany:

"In past years many Germans who had not even the general education necessary to admit them to the study of dentistry went to the United States and in a very short time (three, four, or five months) returned with a doctorate title in one of the specialties of medicine; a title which can be acquired here only by many years of hard labor. In some instances these men could not properly speak German, to say nothing of speaking or understanding English. This incited the envy and just indignation of the German Zahnärzte, who lost no opportunity to make the condition of affairs known, till at present everybody knows of and sneers at the American graduate in dentistry. It is not necessary to recount the endless annoyances and humiliations to which properly graduated and qualified American dentists are subjected in Germany. The injury to the standing of American dentists in Germany cannot be removed without difficulty. The title of D.D.S. will not recover its honored position in this generation, if ever."

If any unjust stigma now rests on the dental institutions of this country, it is proper that it should be removed. As a matter of

information and for removing any prejudice which may exist, this Section recommends that it be empowered to transmit through the United States Bureau of Education to the Minister of Education of Germany, and also to Prince Bismarck, the head of the German Civil Medical System, a copy of the list of dental colleges of the United States, with such additional facts relating to the manner of educating dentists, laws governing practice in the United States, etc., as the Section may deem proper.

In concluding the subject of dental education in the United States, it is further recommended that the officers of dental colleges give space in the announcements to be issued for the session of 1889–90 to the following sentences, which are copied *verbatim* from the latest announcement of the College of Dentistry, University of California:

Under the head, "Requirements for Admission," add: "He shall subscribe to Article II, Section 3, of the Code of Ethics of the American Dental Association."

Under the head, "Requirements for Graduation," add: "He shall again subscribe to Article II, Section 3, of the Code of Ethics of the American Dental Association."

The subject of establishing post-graduate courses for dentists has engaged the attention of the profession for some time, and many able articles recommending them have been published during the last three years. In England and Germany post-graduate courses have been given during the past summer: in the former country at the National Dental College and the Dental Hospital, both of London, and in the latter at the University of Leipzig. The conception of what a post-graduate course should be is entirely different in this country from what it has been made in Europe. The purposes there are similar to our clinics at dental society meetings, consisting of demonstrations and lectures on dental topics. In our own country it has been proposed to make the course one which will benefit the many in the profession who have not had the opportunities for educating themselves in correlative arts and sciences. A post-graduate course would in fact be a scientific and literary education, comprising physics, electricity, metallurgy, microscopy, zoölogy, botany, anatomy, embryology, histology, etc. The Section is not prepared at present to offer a plan showing how these courses should be instituted and conducted, but it fully recognizes the advantages which could be derived therefrom.

Nothing special can be added to what was said in the last annual

report of dentistry in foreign countries, except in a general way that Germany, France, and Great Britain are well supplied with dental institutions. Austria requires a medical degree. Switzerland, Russia, Australia, Peru, and Mexico have one school each, and lectures on dentistry are delivered in some of the other universities of these countries, as also in Japan, Brazil, Chili, Norway, Sweden, Spain, and Italy.

The following resolution was adopted at the last meeting of this Association:

Resolved, That Section II be directed to report at the next meeting of this Association a plan or scheme for the introduction of a course of elementary instruction in dental histology, anatomy, and hygiene into the public schools.

In conformity therewith, the Secretary of the Section sent a copy of the following circular letter to each of the superintendents of instruction of the one hundred and twenty cities of this country which, according to the last (1880) census, contained a population of over 18,000 each, the whole number representing a total population of 10,800,000:

AMERICAN DENTAL ASSOCIATION, SECTION II,
DENTAL EDUCATION, LITERATURE, AND NOMENCLATURE.

DEAR SIR,—As Secretary of Section II, on Dental Education, Literature, and Nomenclature, of the American Dental Association, I was instructed by resolution to communicate with the Superintendents of Public Schools in various cities, in relation to the introduction of a course of elementary instruction in Dental Histology, Anatomy, and Hygiene.

Please reply as promptly as convenient and consistent to the following questions:

1st. According to your judgment, would you consider a course of lectures on the subjects mentioned, delivered at stated times by dentists or physicians, to be of benefit to the pupils?

2d. Do you think the body having control of education in your city would consider the matter favorably, if it is indorsed and recommended by a professional body such as the American Dental Association?

3d. In what grade of the primary, grammar, or other schools would these lectures be most appropriate?

Yours truly,
LOUIS OTTOFY,
Sec'y of Section II, American Dental Association,
1228 Milwaukee Ave., Chicago.

Replies were received from thirty-two cities, representing a population of 4,060,000 in 1880, and an enrolled school population of 750,000 in 1885. Of the thirty-two replies, twenty-four superintendents believe that the instruction would be beneficial to the

pupils; the cities which they represent now have a total school population of 600,000. Only five superintendents believed that such a course of instruction would be of no value, and the school population of the cities which they represent is only 25,000.

To the question whether the various Boards of Education would permit the introduction of dental studies into the schools, twenty superintendents, representing a school population of 460,000, replied in the affirmative; nine superintendents, representing a school population of 140,000, did not believe that the school boards would consider the subject favorably. A large majority are of the opinion that the high and the grammar schools are most appropriate for this purpose.

It is needless to name the various reasons given to justify opposition. In some States, teaching of any kind could not be permitted without a change in the school laws; in other States the superintendents oppose the introduction of additional studies or the taking up of any more time; many do not believe dentists capable of properly teaching children, either because they lack the ability, or would be unable to impress the pupils as a regular teacher should. Some think children's heads are crammed with more than they can digest, and others of the superintendents seem to require a good deal of instruction themselves.

Those who recommend the proposition—and they are in the large majority—would cordially welcome it, if it could be introduced into the schools in a manner suitable to them, so as not to conflict with other duties and obligations. The majority seem to favor the idea that the lectures or teaching should be given in the higher grades of the grammar and the high school, and a few believe that all grades are suitable, provided the lectures are such as to be readily comprehended by the pupil. It appears that many thought expense would be connected with the lectures, and hence feared the proposition would not be sustained by the school board. Many would certainly object to lectures being delivered by any other than the teachers themselves. In this position they can be readily sustained, because it is questionable whether there are many dentists who are properly qualified to teach, and because such a course might be adopted for advertising purposes, and thus endanger professional good-fellowship and create in the public mind an impression of the superiority of one dentist over another. It is indeed doubtful whether dentists would devote the necessary time to the work.

The inquiry has been directed to the points from whence the

greatest opposition was expected—the largest cities of the country. In the larger cities so many studies have been added to the usual course of teaching that, in some instances, it would be almost impossible to add any others.

In some of the States, Anatomy, Physiology, and Hygiene are a part of the course of studies, and in these localities it would be simply necessary to give such aid as would enable the teacher to dwell at greater length, and with more thoroughness, on dental subjects, which are now included in these courses. It might be proper at this point to quote a passage from a letter of the superintendent of schools at New Haven, Conn. "We have," he says, "in accordance with our State laws introduced the study of Anatomy, Physiology, and Hygiene into our schools. The subject of teeth of course comes in as a part of this instruction, and has already created a demand for tooth-brushes in a quarter where they were before unknown."

Having carefully canvassed the subject, your Section is of the opinion that it is quite feasible to introduce dental teaching into the schools of at least twenty large cities, thus placing nearly half a million school-children in a position to be benefited thereby. There is no doubt that in the smaller towns and in the country schools the study could be introduced without any difficulty. The plan proposed consists in the printing of either a suitable book, a pamphlet, or several pamphlets, to be published under the auspices of this Association. The information should be brief, to the point, disrobed of technicalities, up to the present times, and calculated to enlighten the teacher. After the Board of Education in any city has made the study of Dental Physiology and Hygiene obligatory, these books or pamphlets can be furnished to the schools of that city. Teachers would be compelled to enlighten themselves (which most of them would do of their own accord), and to devote a certain number of hours each year to the subject, which would be presented by the teacher to the class in a manner suitable to the age of the pupils, from the first year in the kindergarten to the last in the high school, unless otherwise restricted by the body having control of the schools.

In the larger cities arrangements may be made for a course of lectures by dentists, to which the teachers of the public schools should be admitted. We need only to call your attention to the possible outcome of such a course if continued for a generation in all our schools. The favorable relation existing between the fruits of

such education, and the rapid increase in the number of dentists as shown in the earlier part of this report, is also apparent.

The length of this paper prohibits anything further than merely the mention of the necessity which exists for the publication of suitable books, pamphlets, etc., for the general education of the masses. The want has been felt and is being supplied, in a measure, by individuals and societies. The former usually have as their main objects the personal interests of the publishers; and the latter usually lack the means to properly carry out their plans, are too local in character, and lack the influence and prestige which might be conferred by this Association. The name of no individual or committee should appear on these proposed publications, and they should be sold to dentists at cost, for free distribution among patients. One book or pamphlet should contain all the proper education deemed essential, and portions of this should be printed separately on slips, covering one particular subject only,—say a chapter on filling, on cleaning teeth, on artificial substitutes and their care, etc.,—to be distributed and placed where each will do the most good.

In concluding the subject of dental education, your Section will mention the necessity which exists for the establishment of a National Dental Academy, Museum, and Library, and hopes at some future time to present the matter in proper form for the consideration and action of the Association. Also the matter of appointing dentists to the army and navy and to the various eleemosynary institutions of the land.

The Section would further state that these various investigations demand a great deal of labor, and cannot be pursued without incurring printing, stationery, and postal expenses. While these are merely nominal, the various members of the Section will cheerfully pay them; but if the work of this Section should be continued in the future as it was last year and this year, it would recommend that a small appropriation be placed at its disposal, for the purpose of meeting the necessary incidental expenses.

PART II.—*Dental Literature.*

No material changes have taken place in the field of the periodical literature in any part of the world during the past year, but an addition has been made to the list of publications by the appearance of *El Arte Dental*, in the City of Mexico. To the permanent litera-

ture the following additions have been made since the last meeting of this Association:

A Laboratory Manual of Chemistry, Medical and Pharmaceutical. By Oscar Oldberg, Ph.D., and John H. Long, Sc.D. Pp. 436. W. T. Keener, Chicago, 1887. $3.00.

Traité de Prothèse Buccale et Mécanique. By Dr. Andrieu. Paris, 1887. 18 francs. (Buccal Prothesis and Mechanical Dentistry.)

Wie studirt man Medecin? By Dr. Hugo Dippe. Wie studirt man Zahnheilkunde? By Julius Parreidt, Dentist in Leipzig. (How to study Medicine and Dentistry in Germany.)

Diseases Incident to the First Dentition. By J. W. White, M.D., D.D.S. Philadelphia, 1887. (Reprint from the "American System of Dentistry.")

The Dentist's Manual of Special Chemistry. By Clifford Mitchell, A.B. (Harv.), M.D. Published by the Author. Chicago, 1887. $2.25.

Ein System über das Füllen der Zähne mit Ad. zur Nedden's Crystall-gold. By M. Schlenker. Geo. Poulson, Hamburg, Germany, 1887. (A System of Filling Teeth with Ad. zur Nedden's Crystal Gold.)

Nitrous Oxide: Its Properties, Method of Administration, and Effects. By S. H. Guilford, A.M., D.D.S. Philadelphia, 1887. $1.00.

Transplantation of Teeth into Artificial Sockets. By W. J. Younger, M.D. San Francisco, Cal.

Implantation of Teeth and Pericemental Life. By W. J. Younger, M.D. San Francisco, Cal.

Memoirs of Dr. Samuel Guthrie and the History of the Discovery of Chloroform. By O. Guthrie. Chicago, 1887.

Alveolar Abscess: Growth, Development, and Treatment. By Geo. A. Maxfield, D.D.S. Holyoke, Mass., 1887. (Reprint from the *Independent Practitioner.*)

A Study of the Histological Characters of the Periosteum and Peridental Membrane. By G. V. Black, M.D., D.D.S. Pp. 129. W. T. Keener, Chicago, 1887.

Katechismus der Zahnpflege. By Dr. Ph. Andreae, Hamburg, Germany. Geo. Poulson, 1887. (Catechism of the Care of the Teeth.)

Monographie de la dent de six an. By Dr. E. Andrieu. Paris, 1887. (Monograph of the Sixth-Year Molar.)

Krankheiten der Zunge. By Butlin. Vienna, 1887.

Manuel d'anatomie dentaire, humane et comparée. By Dr. G. Demontporcelet and E. Decaudin. Paris, 1887. (Manual of Human and Comparative Dental Anatomy.)

Zur operativen Behandlung angeborener Gaumenspalten. By Dr. W. D. Dencks. Inaugural thesis, University of Halle. Wittenberg, 1887. (Operative Treatment of Congenital Cleft.)

A. Fanton, Surgeon-Dentist at Orleans: his Life, his Time, and his Works. By R. Fanton. 1887.

Grundriss der Bacterienkunde. By C. Fraenkel. Berlin, 1887. (Elements of Bacteriology.)

La reform de l'art dentaire en Belgique. By C. Godon. Paris, 1887. (The Elevation of Dental Art in Belgium.)

Ueber die Allgemeine Verwendbarkeit der Lustgas—Sauerstoff—Narkosen. By H. Hillischer. Vienna, 1887. (The General Use of Nitrous Oxide Gas as an Anesthetic.) (Reprint.)

Extraction der Zähne. By L. Hollaender. Leipzig, 1887. (Extraction of the Teeth.)

Anesthésie locale. By A. Jousset. Paris, 1887. (Local Anesthesia.)

Essai historique et critique sur les kystes dentaire. By E. Laforesterie. Paris, 1887. (Historical and Critical Essay on Dental Cysts.)

Ein Beitrag zur Behandlung von Kieferbrüchen. By E. Kollmar. Inaugural thesis, University of Jena. (The Treatment of Fractures of the Maxillæ.)

Anesthésie locale pour l'avulsion dentaire. By A. Lebrun. Brussels, 1887. (Local Anesthesia for the Extraction of Teeth.)

Beitrag zur Histologie des Unterkiefergelenks. By Leopold Mankiewicz. Inaugural thesis, University of Jena. (On the Histology of the Inferior Maxillary Articulation.)

Les principaux anesthétiques employés dans le chirurgie dentaire. By A. Pailasson. Paris. (The Principal Anesthetics employed in Dental Surgery.)

Manuel de thérapeutique dentaire speciale et de matière medicale appliquée a l'art dentaire. By C. L. Quincerot. Paris, 1887. (Manual of Special Dental Therapeutics and of Medicines employed in Dental Practice.)

Das Lustgas und seine Verwendbarkeit in der Chirurgie. By C. Schrauth. Leipzig, 1887. (Laughing-Gas and its Application in Surgery.)

Local Anesthetics for the Extraction of Teeth. In French by Geo. Vieu, translated into German by B. Manassewitch.

Deutsche Zahnheilkunde in Vorträgen. By Adolf Witzel, M.D. Essen, Germany, 1887. (Lectures on German Dentistry.)

Dental Metallurgy. By Chas. J. Essig, M.D., D.D.S. Philadelphia, 1888. Second edition.

Dental Kalender für Deutschland. By Erich Richter, M.D., D.D.S. Breslau, Germany.

Die Infectiöse Arthro-Dentäre Gingivitis. (Pyorrhea Alveolaris.) In French by Dr. Galippe. Paris, 1888. Translated into German by B. Manassewitch.

Dental Caries and the Prevention of Dental Caries. By Henry Sewill, M.R.C.S., L.D.S. London (second edition), 1888.

The Legal Status of Dentists. By Daniel Nason, Esq. New York, 1887. (Reprint.)

On the Physiological Action of Cocaine on the Lower Animals and its Use in Dental Surgery. By Geo. Cunningham, B.A. (Cantab), D.M.D. (Harv.), L.D.S. (Eng.). London, 1887.

A Compendium of Dentistry. By J. Parreidt. Leipzig. Translated by Louis Ottofy, D.D.S. Notes and Additions by G. V. Black, M.D., D.D.S. Chicago, Ill., W. T. Keener, 1888. $2.50.

Das Füllen der Zähne bei intacter Pulpa. By Ludwig Warnekros. Berlin, 1888. (Filling Teeth, when the Pulp is Intact.)

Ueber Bissarten und Bissanomalien. By Alfred Sternfeld, M.D. Munich, Germany, 1888. (Characteristics and Anomalies of the Bite.)

Aids to Dental Surgery. By A. S. Underwood, M.R.C.S., L.D.S. London, 1888.

Handbuch der Zahnersatzkunde. By J. Chruschtschoff. St. Petersburg, Russia, 1888. (Manual of Prothetic Dentistry.)

Ueber pathogene Mundpilze. Inaugural thesis, University of Berlin. By W. D. Miller, Ph.D., D.D.S. Berlin, 1888. (Pathogenic Microbes of the Mouth.)

Irregularities of the Teeth and their Treatment. By Eugene S. Talbot, M.D., D.D.S., Chicago. P. Blakiston, Son & Co., Philadelphia, 1888.

L'avenir de l'art dentaire en France. By E. Lecaudey. Paris, 1888. (The Future of Dentistry in France.)

Beecher's Dental Directory of the United States. By M. P. Beecher. New York, 1888.

Lectures on Certain Diseases of the Jaws. By Christopher Heath, F.R.C.S. London, 1888.

Note-Book for Dental Students (Dental Anatomy and Physiology). By James Rymer, L.D.S., M.R.C.S. London, 1888.

The Student's Manual and Hand-book for the Laboratory. By L. P. Haskell, D.D.S. Chicago, 1888.

Eine conservative Behandlung der erkrankten Zahnpulpa. Otto Walkhoff. Leipzig, 1888. (Conservative Treatment of Diseased Pulps.)

Anæsthetics. By D. W. Buxton, M.D., B.S. Philadelphia, 1888. $1.25.

Die Krankheiten der Mundhöhle, des Rachens und der Nase. By Dr. Phil. Schech. Munich, Germany, 1888. (Diseases of the Oral Cavity, Throat, and Nose.)

A Practical Treatise on Artificial Crown- and Bridge-Work. By George Evans. With 500 Illustrations. Philadelphia, The S. S. White Dental Mfg. Co., 1888.

The length of this report precludes any further notice of even the most important of these works.

Numerous minor pamphlets and society proceedings have appeared during the year, and dental literature in the main has kept pace with the advance made in all the arts and sciences.

PART III.—*Dental Nomenclature.*

It is doubtful whether any reference to this subject ought to be made at all, for nothing has come to light during the year. A few brief articles have appeared in the periodical literature, but while these are merely the expressions of individual opinion, generally based on the peculiarities of the language and nation from which they emanate, they cannot be considered in any sense as additions to or improvements on nomenclature, of which no recognized system exists.

In the last annual report this Section recommended that this matter should be taken into consideration by some international organization, but since no permanent international organization exists, and since the Sections of any Medical Congress are of necessity made up of an ever-changing membership, the nomination of an *International Council on Nomenclature and Notation* is proposed, as it would seem to offer the most feasible solution of this problem. With this object in view, the Section would recommend the appointment of a council of twelve, whose object it shall be to secure the appointment of similar councils by the national associations of Great Britain, France, Germany, Austria, Spain, Italy, and other countries where such may exist. These councils could meet in their respective countries from time to time; for convenience,

annually (at the time and place of the meetings of the body which appointed them). They could confer with one another, and each could consider, vote upon, adopt, modify, or reject the acts of the others, thus formulating and establishing a system which will at once be universal, reliable, and scientifically proper. The Section calls the serious attention of the members of the Association to this important matter.

SECTION II.—Continued.

The Basis for Teaching Nomenclature—Terminology and Education.

PAPER BY W. H. ATKINSON, OF THE AMERICAN DENTAL ASSOCIATION.

"The light of the body is the eye: if therefore thine eye be single, thy whole body shall be full of light. But if thine eye be evil, thy whole body shall be full of darkness. If therefore the light that is in thee be darkness, how great is that darkness!—MATT. vi. 22, 23.

TO comprehend the possibilities and probabilities in functional activities in normal and abnormal instances of growth and nutrition of the bodies subject to these changes, it will be necessary to apprehend the coming into being and behavior of, no less than the degrees of susceptibility to, incoming energy by which strength or weakness of these factors or subjects of function are endowed. In fact, the manner and degree of endowment of functional power is the only proper basis for classification. Function means movement, —in condition or of place; condition signifying relation of part to part, and place of being to being. Personality of the identity and the medium in which it exists must be determined to lay the foundation of change capable of being perceived and examined for characteristics by which to discriminate the changes of body in mass and the molecular and volitive changes, the aggregations and correlations of which produce the more obvious mass-motions pertaining to the individuals and the masses of bodies under examination, so as to congruously catalogue them in class, order, genus, species, and variety.

Entities and the media in which they subsist are now attracting more general attention than at any former period. But these studies are so overloaded with the former bad classification as to cripple our efforts to get at a satisfactory comprehension for the starting-place of the doings of these bodies in a habitat without which they do not appear to sensuous perception.

The mycologists call this habitat "culture-medium," but they do not stop to investigate the intrinsic massing of primal elements (atoms); the appeasing of the hunger of which, sufficiently to afford lodgment and support for the ferment bacterium capable of propagating the molecular changes which constitute the feeding of the ferment-body by the fermentable medium,—be it a fibrinous, albuminous, or hydro-carbon form of digestive activity of the medium,—is effected. From the time of Jenner, this question of well or poorly elaborated medium has been more and more pressing for satisfactory solution by the leading physiologists. Jenner noticed that only a part of those who milked the cows afflicted with "the pock" were infected so as to have the ferment set up the fever in the juices of the flesh, which was the culture-medium for the micro-organism without which the pock-fever did not appear. He further took note of the fact of the immunity from infection of the variolus virus which these people enjoyed. But he did not seem to follow out his reasoning upon the *non*-appearance of the pock in the rest of the milkers.

Had he taken this into account, would he not have been led to conclude that those who did not take the fever had such a well-elaborated medium as not to afford lodging or support to the infection with which they came in contact in milking equal to those who took it? Infections, impregnations, and contagions are only capable of "taking" where a certain degree of ripeness of protoplasmic churnings have developed affinities in the magma of "infectible"—"pregnable,"—or susceptible bodies so as to effect new combinations in the molecular mass, which is then the "culture-medium" in which the seminal impacts work out their fermentative or putrefactive mission.

Where the awakening and engagement of bonds of affinity in atoms takes on the fermentative form of molecular metamorphosis old molecules are broken up and new ones of less or greater complication occur.

Thus more stable or less stable molecules are formed in which the urge is quieted in a greater or less degree than it was in the fermentable body in which the (boiling) fermentation took place. So that these are less susceptible to incoming impact on the one hand, and on the other more easily aroused to new activity in the more complicated plasmic mass which they form under typal guidance, of cosmical, planetary, or individual radiant and irradiant impact into ether, air, vapor, water, colloid, and solid bodies constituting the lay-out of the field of our study of function (doing).

The order of functional procession is: 1st, Cosmic; 2d, Planetary

or Earthy; 3d, Aerial; 4th, Combustive or Fiery; and 5th, Aqueous or Watery—processes, the interpenetration and mutual modifications of which are so occult as to render it difficult of apprehension and statement so as to meet the demand of materialistic scientism.

All these processes and the bodies thus brought within the range of sensuous perception are embodiments of power, the measure and the modes of which mark their differentiations and mutations that constitute anatomy, physiology, pathology, metamorphosis, restoration and destruction, so important for us to comprehend and formulate as the only effective basis of study for practicalization of our chosen and adored calling in life!

In the human being any impact or epact capable of cognition by the senses may be the inception of polarization, depolarization, acceleration, retardation, or arrest of current in the elaboration of function.

As function is effecting of the purposes of being in currents and counter-currents involving demand and supply of the adequate energy, we are naturally led to the contemplation of "stato-motism" or polarization as the basis of cosmical, planetary, and personal movements.

Stato-motism in the cosmical plenum of molecular mass may be said to stand as the coiled tension or potential energy in mind and matter, ever ready and ever operating cosmical, planetary, and personal rounds of perpetual activities!!

Statism (stand-still) and motism (the go-on) are like the first postulate (the atom), capable of being fully comprehended only by a sort of fictional compromise in statement, as each has two aspects of presence like the atom, the name of which is no longer tenable when we closely study molecular constitutions.

So the emotism of solar fullness is a sort of statism until it springs into motism at the demand of planetary voidness as statism asking to be infilled with radiance, which now gives it motic character, and thus we readily see that our definitions are not finalities except as to statements of relation of numbers. These are eternal verities! Such as "the whole is the sum of all its parts"—to wholly understand a part its connections must be comprehended. A complete survey of all the connections of a part will lead in the end to a comprehension of the whole.

Let us then endeavor to follow the alternations of deficiency and sufficiency, or emptiness and fullness, of the receptacles in which the discriminative measures of power are stored, and learn that they are

but infinitesimal repetitions of movements between cosmic fullness and planetary voidness in chaotic masses, by which all forming and feeding of individual bodies are produced and maintained. May we not readily see that a key which opens any department of the beautiful house we live in, will unlock, with the requisite modifications, the entire macrocosm of which it is an accurate microcosmic representation?

This key is a knowledge of the metamorphoses of prime elements in combinations and separations which are known as atoms.

Movements of atoms result in their change of place and change of character. In the first instance they are moved in mass in space and moved apart or nearer together without combination or coherence; in the second instance they are formed into new bodies by arousing inherent or communicated measures of affinity, or bonds of energy, by which they interpenetrate each other, and forming new bodies take the name of molecules. Of these there are two forms or sorts. The first is when the awakened bonds of combining power are in atoms of the same character; the second is where atoms of diverse nature are within the sphere of influence when their bonds are awakened. The first form consists of oxygen, hydrogen, carbon, or other primal gaseous body, which is now called nascent or ready to be born into the molecule, properly so called, of at least two diverse molecules of the first or preparatory order of holding together atoms of the same class.

The degree of strength of the grip holding elements in combination is the measure of permanency or evanescence of the body so composed.

A good example of this strongly held and loosely held element is shown in water H_2O and peroxide of hydrogen H_2O_2. In the latter the extra equivalent of oxygen is so loosely held as to demand quiet and a temperature below 65° Fahr. to prevent spontaneous dissociation of the loosely held oxygen, leaving the water molecule of H_2O in the liquid state in the bottom of the chamber in which it is held, while the oxygen in gaseous form occupies the upper part of the chamber.

This is the *a*, *b*, *c* of function, and when exhaustively studied gives us the means of comprehending healthy and unhealthy modes of expression which are nominated disease in the text-books extant.

Instead of scanning down to the lowest and simplest forms of disturbance, which reveals the changes in prime and proximate elements, the whole system and its parts in regions and in organs

have been made the territory in which have been sought explanations of the changes involved in physiology, pathology, and cure.

Physiology is the full and direct play of currents of affinity, thus producing strong and well-formed molecules, of which healthy bodies are constructed which operate all the functions with *ease;* while pathology is the minified, deflected, and split currents of combining energy, producing unstable and weak molecular mass, thus inaugurating *dis*ease in the very elements of the tissues and organs composing the functioning body. Anything which arrests retrogressive nutrient action and promotes progressive nutrient activity is a therapeutic agent or *cure.*

SECTION II.—Continued.

Dental Education.

PAPER BY B. HOLLY SMITH, OF THE SOUTHERN DENTAL ASSOCIATION.

THE assignment of dentistry to its proper position among professions, and the decision of the proper elements of a dental education, are correlative questions; the one acting upon and shaping the other. According to the medium through which one sees dentistry, will appear his opinion of the requisites and essentials to training in that calling and fitting for it. And from the many eminent dentists who have discussed the problem, we have a variety of views as to the object to be accomplished, and the best means of accomplishing that object; all influenced to a great extent by the attitude of the individual toward the profession, and born of his conception of the profession's destiny and work. To read some of the discussions, one might think dentistry some object of curiosity, which, from its hybrid or composite nature, scientists found very difficult to classify,—to discover its proper family, genus, and species. And although the opinions of many are tinctured with vanity, and disfigured by an overweening anxiety for position and distinction, which they seem to forget must come to a profession when the nobility of its labor, the extent and severity of its requirements, the quality and eminence of its attainments, make it a sphere for true workmen, a study for earnest students, and a field for patient scientists; yet the vast majority of those who have written on the subject show a fervent desire for elevation and advance,—an elevation born of a true conception of dentistry's mission, and an advance which is her right and destiny. In fact, elevation of the educational standard, increased severity in tests of acquirements, extension of course, and a higher grade of attainments for dental students and practitioners, seem to be uppermost in the minds of all earnest thinkers and writers on this subject. For all are beginning to

recognize that though many of the conditions which first made special dental education and dental colleges a necessity no longer exist,—though the education is no longer a trading in secrets, and the practice no longer a quackery and charlatanism,—yet the very fact that the position of dentistry has changed, that its attitude towards the world as a profession is different, increases the necessity for more strenuous efforts on our part, that the education requisite for admission into our profession should be such as fits its high calling and exalted claims.

We are beginning to see, also, that much as we may esteem and revere those who are eminent, not only in our own profession, but in the scientific world, on account of the distinction and merits of their knowledge and acquirements,—proud as we may be of the credit they reflect on dentistry,—yet dentistry needs more than that. Dentistry cannot be satisfied with the fact that a few of her sons are pointed out as great in their work and attainments; but can require nothing less than that a high standard of education be set for every one who desires to practice the profession, that her humblest sons shall go through a course of study, whose thoroughness and extent shall make the degree of D.D.S. no longer the "badge of partial culture."

The fact is beginning to dawn on us that the hedges are too low, and that our profession is too easy of access; that it is too easy for imperfectly trained young men to be turned loose on the world, bearing but dishonoring the name of dentist.

Such are the ideas and opinions of many whose labor in their chosen calling, and whose attachment to it, have made them distinguished; and their arguments and reasonings are undoubtedly due to a proper conception of what is a necessary training for the right accomplishment of the work of dentistry. Laying aside all questions which have their origin in any false pride with regard to the relative position of dentistry as a profession, they have looked upon it as an agent for the accomplishment of a certain and definitely specified work, and they have become convinced that the character, extent, and scope of that work justify them in claiming from those who aspire to enter dentistry abundant evidence of natural ability, patient study, and extended preparation. To them it has seemed that the claims of their profession should be marked by what it does and is, and they have sought, and are seeking, to inculcate these high views in every student who aspires to be a dentist.

While there has been this unanimity of opinion among all writers

on the subject of dental education, as to the desirability and necessity of a more thorough preparation and a more extended course, they are sadly at variance as to the methods to be pursued.

Schemes of fusion and alliance with medical colleges have been suggested; the establishment of a chair of dentistry in a medical college; on the one hand the complete subordination of dentistry to general medicine, on the other a smattering of medical education. All have been argued for, and all or nearly all have been tried, and are being tried. To the unbiased the following propositions are submitted as not inconsistent, and as capable of being assented to by all:

First—Dentistry as a profession, founded on a knowledge of scientific truth, a successful application of scientific principles, and requiring, moreover, in the highest degree, hand and eye training, should have, prominent among the elements of its preparatory education, a training in scientific studies and methods, and the cultivation of manual dexterity.

Second—Dentistry as a specialty of medicine requires that its practitioners lay the foundation of their special training in a knowledge of the general principles of medicine.

Third—Dentistry, as a specialty, demands a special as well as a general knowledge,—not theoretical only, but practical.

In defence of the first proposition, I do not suppose it will be for one moment questioned that there should be a considerable and thorough preparatory education, before entering upon the subject of dentistry proper, nor will it need argument to convince my hearers that a course of preparatory study, demonstrably best adapted to a general training and discipline of the mental powers, and at the same time best fitted to the special work the student is to pursue, must be the best possible preparatory education.

As to the general discipline and effect of scientific studies on the mental powers of the student, I need only cite so eminent an authority as Herbert Spencer, who in his work on education says,—

"To the question: What knowledge is of most worth? the uniform reply is, science. For the purposes of discipline—intellectual, moral, religious—the most efficient study is science. Necessary and eternal as are its truths, all science concerns all mankind for all time. Equally at present as in the remotest future must it be of incalculable importance for the regulation of their conduct, that men should understand the science of life, physical, mental, and social; that they should understand all other science as a key to the science of life."

As to the special value such studies will have for those whose whole life will have to deal with facts based on their proper appreciation and understanding, nothing need be said.

With regard to the desirability of educating the hand and eye of the youth who proposes to study dentistry, as an element of his preliminary course, it may be remarked that among all prominent educators such a training is looked upon as requisite and essential, valued as well for its disciplinary power as for the effective force it gives to him who has the eye to see and the hand to do. For it is not alone to the mechanic and the machinist that the niceties of sight and touch are valuable. The success of men in almost every walk in life may depend upon them, and especially of the surgeon or dentist. It is true that in the training intended to fit him directly for his profession, much of this delicacy and accuracy of sense is acquired, but how much better if begun when the faculty of its acquisition is vastly greater and the members to be trained vastly more adaptive. The truth is that it has been too often and too generally attempted to unite in the same short course the preparatory studies and the direct preparation for the practice of our profession; or rather the preparatory part of the course has been omitted, and the attempt has been made to create theoretical physicians and skillful operators out of absolutely crude material. It is true that it may be a long time before the sentiment in favor of a thorough preparatory course of study for dentistry will become so strong as to induce such a preparation as is now possible for medicine proper in the Johns Hopkins University in Baltimore. There, from the moment the student enters the University, he may give his studies that bent, and enter upon the study of his chosen profession with a most splendid equipment of preliminary knowledge, and scientific habits and tendencies. Of course, it is not to be supposed that every student of general medicine, much less of dentistry, can go through so admirable a preparatory course; but one can but reflect upon the added lustre to medical fame and learning, which the mere existence of such an opportunity creates. The very fact that the medical profession lays so splendidly equipped an institution under contribution for its material, and the fact that such preparation as that institution can give is looked upon as necessary to the medical student, must give added dignity and worth to the profession, and ground its ever-increasing triumphs deep in the granite of scientific truth.

While we cannot expect at once that our students shall have the

patience and ambition to emulate the few enthusiastic men who approach their chosen life-work through so complete a training, yet it is our duty as dentists to create a sentiment, and a strong sentiment, for a preparatory education of the right character, and to endeavor to show students the demand and the necessity for such an education.

With regard to the second proposition which I have enunciated, I am sure that I voice the views and opinions of all the leading minds of our profession. Dentistry, as a specialty of medicine, requires that its practitioners lay the foundation of their special knowledge in a knowledge of the general principles of medicine. This view began to be held soon after the establishment of schools, for the study of dentistry had so greatly benefited it, and had given it so powerful an impulse forward, and delivered it from the dominion of secret trading and empirical blundering, and had fixed the body of its principles and the essentials of its practice into a definite form that might be studied and investigated.

This view has been reiterated with the ever-increasing emphasis of conviction and truth, until medicine itself has heard and recognized it. The fact that such a view is so generally held, argues a profounder investigation of the principles of our profession and a clearer perception of its proper place. We see better what dentistry is, and we understand more clearly what is necessary to make a dentist.

That dentistry is a specialty of medicine could not long escape the observation of those who studied and practiced it, and that a medical education was but the natural outcome or sequence of that idea. It was on the method of accomplishing this much-wished-for end that there has been such a variety of opinions. Whatever may be the harmonious adjustment of the various plans for this necessary extension of a dentist's education, I for one cannot see that the necessity for dental colleges has ceased to exist. For although many of the reasons which led to their establishment have lost some of their cogency, it must be remembered that it was because of their establishment that the reasons have ceased; and although it is a fact that medicine recognizes dentistry as one of its specialties, we must not forget the part the dental college and its training have had in enforcing that recognition. Nor yet is to be left out of view that other fact,—the engrossing character of this particular specialty, the extent and severity of its demands upon our time and labor, for, as I have before stated, dentistry as a specialty demands

a special as well as a general knowledge, not theoretical only, but practical.

Elevate the standard of professional education as much as you may,—and no one is willing to go further than I in support of this praiseworthy aim,—broaden the foundation, increase the severity of those tests which show a proper study and culture, but you cannot, by any general study, however extended and elevated, do away with the necessity for a thorough special education. It is the law of any profession or science as far-reaching and comprehensive as medicine, to differentiate or multiply into specialties, and we must dismiss the idea that a depreciation of the specialty adds in any way to the worth and dignity of the parent profession. On the contrary, such can but be a detraction from that profession's weight and usefulness. For it is the fidelity and patience of special investigation and study that must extend the knowledge, multiply the resources, and increase the power of the general science; and he is recreant not only to his specialty, but to the larger and embracing profession, who feels an unmanly shame at what he deems the unimportance of his position in the great field of scientific investigation, which can only be accurately worked through his faithfulness and painstaking.

Again, as the interests of the larger profession are best subserved by an intelligent and conscientious attention to the details and requirements of the specialty, on the other hand the care of the specialty and its peculiar functional development cannot be safely intrusted to the general practitioner.

It would in this day be very little to the credit of such a profession as medicine, to think that one man can know it all; and even dentistry, specialty as it is, is beginning to have its specialties.

Now, we cannot, and we would not if we could, hinder this differentiation, this development and multiplication of specialties, because it comes of a knowledge which, though it may seem contracted in the individual instance, is nevertheless an addition to the vast aggregate. Neither can we, in the nature of things, master it all; so there remains the choice between a lamentable failure in attempting too much and the success which awaits concentrated, intelligent effort.

In fact, the necessity for education in the general principles of medicine is a necessity born of the requisites of dentistry and to be done for the advantage of dentistry,—to bring to its ranks better-trained men.

To the unreflecting it may be that such views may be open to the charge of narrowness, but not to such as comprehend the tax on ability, time, and labor which the mastery of dentistry involves. The very strength of the demand for a higher grade of education among dentists is encouraging to us, chiefly because it shows that the scope and extent of the work of dentistry is so much better understood, and as an inevitable consequence we are using our utmost endeavors to perfect the agencies for the accomplishment of that work.

And to whom should the improving and perfecting of these agencies be intrusted, if not to dentists,—to men who have their deepest interest in the specialty, and not in the general profession?

It is a matter for great congratulation to the profession generally that we have an instrumentality already organized and destined to increase in power and influence, whose effect should be most salutary and beneficent on dentistry, in guarding it against too easy access by unfit and imperfectly educated men, and in elevating and extending the course of study required for admission to our ranks. I allude to the Association of Faculties; for of course it is the united and persistent effort of the whole profession that is needed to make this elevation an accomplished fact. Just as the accomplishments and attainments of a few eminent dentists cannot be cited to relieve the rank and file of the profession from the imputation of a partial culture, but a high degree of acquirements must be made the test for admission, so the utterances and addresses of our most eminent thinkers in favor of advanced education will go by as the "idle wind," unless there is a union and consistence of effort. We need the strength that is in union. We need it that all may insist on the cardinal points which we may all unite in calling necessary:

1st. The creation of a sentiment in favor of a special preparatory course looking towards the study of dentistry.

2d. The elevation of the standard of education in dental colleges, and a corresponding extension of the term.

3d. More careful supervision and inspection of the entrance of men into the profession who do not come into it through colleges.

To effect these results, I repeat, we need a closer union, one that will equalize hardships, stifle petty jealousies and rivalries, and awaken in us all a nobler emulation.

Now, it appears to me that it is in the power of the Association of Faculties to accomplish what we desire in this direction. To unite upon a plan which all can follow should not be a matter of

great difficulty among men earnestly bent on the same meritorious object, and willing to sacrifice in unimportant details that the great central purpose may be accomplished.

Let the degree conferred by any faculty of that association be the essential prerequisite to an entry into dentistry,—at least, for a reputable entry,—and they have a power and an influence for good. They can insist on proper training, extension of course, and higher grade of requirements, uninfluenced by the fact that some other institution can make dentists more quickly and more cheaply.

As to what the degree is to be called, that is a minor consideration. When the attainment of the degree means thorough preparation and earnest study, it will no longer be reflected upon as the "badge of partial culture."

This seems to me the most practical solution of the problem, so interesting to us now. If we expect to accomplish any noticeable results for the educational advancement of our profession, with its accompanying extension of term and increase in severity of course, we must all unite in the effort, if such an elevation in educational requirements is to be made the test for all, not for a few.

The entrance into the profession of men by other avenues than through a regular and reputable college course is a matter for our careful consideration, though, of course, its importance decreases as the number so admitted decreases.

I shall not at this day go into an extended argument in favor of the college, and against the side-door entry, but will simply say, while I admit the presence among us of men without college-given degrees, and admire them heartily, I do not think it to the credit of the profession that a state of things born of the youth of our profession should be permitted any longer to exist, and I think this because the conditions which made this possible no longer exist. It is no depreciation of the vigor and worth of our hardy pioneers to say that the present state of dentistry cannot be satisfied with anything short of actual evidence of careful preparation on the part of its practitioners; and it cannot be expected that men who pass dental boards are to be compared with those who have been born with dentistry, so to speak, and have kept up with it ever since. The State boards of dental examiners have been the legal bulwarks, as it were, which dentistry has set up against this class of irregular practitioners. There is surely nothing to be said against having some test, and the protection of law to that test, but it may be questionable as to whether such tests are the best to be had.

And when I say this, there is no imputation against the ability, learning, or conscientiousness of the gentlemen who compose these boards. They have had an important duty to perform, and have done it well,—to use the epitome of praise, to the best of their ability; but I simply desire to contrast the evidence that a student has gone through with a well-chosen and thorough course, with the fact that a man has answered a majority of the questions a dental examiner may have asked him, and let anyone decide, other things being equal, which is the better test of ability and proficiency.

The difficulty lies in the nature of the case. Examinations are but imperfect tests at best, and they cannot always be given at best. Let us suppose them absolutely pure, there yet unquestionably remains the opportunity for that political taint, which in its mere possibility or probability is a menace and a blight; besides they are not, nor can they, in the nature of the case, be comprehensive. The examiner stands more in the light of an officer of the law whose duty it is to protect the community from criminal ignorance and stupidity, than of a member of the profession whose object it is to elevate and advance the profession, and in that capacity he must generally be satisfied with such a minimum of skill and knowledge as will insure a reasonable degree of safety and protection to the community. The protection afforded the profession from a consequent depression is merely incident, and not the chief thing to be considered. Of course, we cannot do away with such tests, if no others are to be substituted; but why not put it into the power of the Association of Faculties to demand a diploma as a better and more satisfactory test? Do you say it would work hardship to the individual?—so it would, but think of the benefit to the profession and to the public. It could not affect those who are in. Artemus Ward, in his enthusiasm for the late war, said he was willing to sacrifice every able-bodied relative his wife had, that it might be successfully prosecuted; and I feel inclined to sacrifice a few of our irregular would-be dentists that the profession may reap the benefits.

SECTION II.—Continued.

Methods in Dental College Education.

PAPER BY L. C. INGERSOLL, OF THE AMERICAN DENTAL ASSOCIATION.

EDUCATION is a term which signifies the state of the world's enlightenment and progress,—a coming up out of a low state to a higher state of mental, moral, and physical development.

It is an interesting study of history to look back over the long track of the ages and observe by what methods the world has been educated. The race is made up of individuals, each in a condition of primary independence. Hence the race as a whole can only be educated by an education of the individual members of the race. How to accomplish this successfully is the problem of the world's advancement.

Men are not like grains of wheat. When you look over a Dakota wheat-farm stretching out miles before you, you see every head of wheat like every other head; and when the threshers give the chaff to the wind and gather up the millions of bushels of grain, each grain is like every other grain, with the same possibilities of development and growth. Cadmus,—who might be styled the mythical father of dentists,—catching the inspiration of nature, thought to sow teeth, as wheat, and raise an army of men. When they came up, unlike wheat, they were of every degree of strength, endurance, adaptability, and possibility of development and service. This difference in mankind makes the problem of education a complex and difficult one. Shall it be of the individual alone, or of masses of individuals? When a number of individuals are gathered together with a common purpose to learn something that they did not know before, we call it a school. Schools are as old as human society. When the school is gathered, the question arises, How shall it be organized, how begin, and how proceed? These are resolved into the *one* question of *methods of education.*

The school is a natural product of society; but methods of conducting it are artificial and arbitrary. It is easy to organize for educational purposes, but not easy to agree on the methods of accomplishing the object, for many do not see the importance of well-defined methods.

The true value of a school, measured by results, does not depend so much upon imposing edifices, ample equipments, and a long list of instructors named and titled, as upon the methods and manner of instruction. Methods are seldom talked of and little appreciated in our professional schools. But the method of doing anything is the all-important feature of the doing. The valued and ideal home is not constituted chiefly by a commodious house, elegant furnishing, husband, wife, and children, but by the manner of conducting the home. Many medicinal compounds are valueless unless a certain method is observed in the compounding. It is strange that even intelligent men do not more highly appreciate the importance of methods.

I had occasion a few days since to make a concrete for a foundation, and I instructed an intelligent mechanic, accustomed to the work, as to how I wanted it made. He very readily comprehended the necessity of having good cement, clean, sharp sand, macadam rock free from dirt, and clear water; but he did not seem to comprehend the importance of exact method in putting the materials together. He got the general idea that these materials were to be mixed together, but he did not comprehend that he must adopt a method that would secure a coating of cement on each grain of sand and a coating of cement mortar on each piece of macadam before shoveling the mixture into the trench, in order to secure the absolute solidity of the mass.

Every dentist knows that elegant equipment of an office will not, as a matter of course, secure good gold filling; but the value of the filling depends upon the method of putting the gold into the tooth to be filled.

Is it not time to examine our educational methods? Chief among the methods employed in our schools is the lecture system. This method of communicating instruction has the merit of great economy of time and labor, for a man can deliver a lecture to one hundred pupils in the same time and with the same effort as he could deliver the same lecture to a single individual. As an argument in favor of the lecture system, it admirably favors the lecturer. But other persons are concerned besides the lecturer,—there are

the teacher and the taught. Each pupil has an individual interest to be served. The lecture is not given for the benefit of the teacher, but for the benefit of the pupil. How are *his* interests served? Is the lecture system the best mode of instruction considered from the stand-point of the pupil?

Popular lectures for great masses of individuals, as in a political campaign, may be a necessity; but the political education of the people would be meager indeed were it not for the daily and weekly press as text-books for study.

In no period of the world has the giving of solid and permanent instruction been intrusted to the lecture system. It is adapted to but two classes of mankind,—to children too young to read, and to those already well instructed and educated.

To derive benefit from lectures the pupil must have a disciplined mind, quick perception, ready analysis and generalization of thought, comparison, and a retentive memory. But unfortunately this is not the class that fill our colleges. Our students belong to the more numerous middle class, who can be considered as possessing the qualities of mind enumerated above in but a very limited degree. They need to *study* and take time to revolve the thought in the mind, in order to see its bearing on the general subject and to understand its practical relations. These processes of mind are not possible with the rapid flow of ideas communicated in a lecture. Nor does the custom of note-taking, on the part of the student, very much improve his facilities for acquiring a knowledge of the lecture. There are but few rapid writers among students, and even the best of them, while jotting down one important fact or principle, is quite likely to allow several just as important principles expressed by the lecturer to pass unnoticed. It must therefore be evident from every view of the case that the amount of knowledge acquired and fixed in the memory by hearing a lecture is extremely limited. If the student makes the attempt to refresh his memory by reading reference-books, he is sometimes obliged to go over from one hundred to two hundred pages; which having read, he finds himself clearly recognizing but here and there a thought expressed in the lecture. In the pressure of work forced upon the student by the numerous appointments of the day, very few ever find time for such reading except by intrenching on the hours of sleep.

Before the age of books, lectures and oral instruction were the only means of popular and professional education. At the gates of entrance to large cities, where, on the days of the performance

of various religious rites, there were gathered large assemblages of people from the adjacent country, the lecture platform was established. But not this alone. Groups of individuals were here and there gathered by those specially adapted to give colloquial instruction. In a lecture recently delivered by Henry Clay Trumbull at Yale College, he says, "It was about 80 to 70 B.C. that Simon ben Shetach, as president of the Sanhedrim, established a system of elementary religious schools. In addition to these elementary Bible schools, there were more advanced Bible schools in connection with every local synagogue. The afternoon service of the synagogue was one of interlocutory Bible study for young and old together. The method of instruction was entirely interlocutory and catechetical. Great importance was attached to this method. A responsibility was regarded as resting upon the Jewish teacher to *teach* his scholars, not merely *talk* to them."

It was at the time of this strict adherence to the interlocutory method that Christ the Divine Teacher was born. He is spoken of as both preaching to and teaching the people. His sermons were very few. But he often taught in the temples, by the wayside, on the fishing-grounds, in the market-places, and often called small groups aside to some retired spot for instruction, when his method was that of dialogue, or questions and answers. These are most worthy examples of the sure and true method of permanently fixing instruction in the mind. This was an age without books. The manuscript rolls chained to the platform in the temple, or locked in the archives of the government, were accessible only to the teachers.

In the days of Egypt's greatness thousands of manuscript rolls of papyrus were gathered in the great Alexandrian Library, treating of all matters of science and religion; all the specialties of medicine were taught, even dentistry, by lectures and otherwise; the teachers only, by special favor, having access to the library. Hence it will appear that the lecture system was a necessity growing out of the want of books. But the lecture system did not lose greatly its popularity by the invention of the art of printing and the introduction of books. For the priests, who were the only authorized teachers, had taught, and the people had believed, that their words were inspired by the gods,—that knowledge gained otherwise than from them was but deception and lies. When the people came to them as the only true source of knowledge their pride was greatly fostered, and to keep up this inspiring flattery it was necessary that the teachers should discourage the use of books. Is it not true now

that there is much of pedagogic pride to be overcome before the advent of text-books into our professional schools? Do not instructors hug to their bosoms much of solacing flattery when the class sitting before them respond *ipse dixit?*

We may learn much from religious schools, which are well known for thoroughness in imparting and fixing instruction permanently in the mind. The Jewish, Catholic, Presbyterian, Methodist, and Congregational denominations alike trust to catechetical schools chiefly for teaching doctrine, and to sermons for illustration and enforcement of the principles taught in the schools by the aid of elementary text-books. Homiletic teaching is an education more largely of the sensibilities than of the intellect.

We may learn much also from our literary institutions where the elements of all science and learning are taught. In all grades of these schools, from the common school to the highest college, the method is that of text-books without lectures, and the recitations are catechetical. There is no other method of instruction so impressive as questions and answers.

The most effective political speech that I have listened to during the present campaign was one delivered by Hepburn, of Iowa, which was made up entirely, from beginning to ending, of questions and brief and pointed answers,—the interlocutors introduced being father and son talking over the political differences of the two great parties.

Think of teaching arithmetic and grammar by lectures, instead of by text-books of rules and principles to be memorized! The lecture is legitimate in the higher branches of mathematics,—in practical trigonometry and astronomy,—and in philology and the structure of language; for the pupils in these studies are educated up to the lecture standard. But in elementary teaching the lecture should take the lower place, not the higher.

The educators in our common and high schools make a constant study of methods of instruction. The Normal, a modern institution, is a school for the inculcation of methods of education. Yet how little do our professional schools profit by it! Why not teach dentistry, in its scientific branches, as mathematics and language are taught? We need to have more teaching and less talk,—more study of books and less rambling over the broad fields of science in the gay attire of eloquent words. Can you teach botany by taking your pupils on a stroll through a flower-garden, or by giving them a ride over the prairie in a cart? No: the student must get down out of

the cart and pluck the flower, and with book in hand analyze it. He must pull the various grasses and compare them by close study of their peculiarities.

The method in our colleges and universities for more than a century has been to give instruction, almost exclusively, by text-books and recitations, requiring that rules and principles be memorized from the text, word by word. Memorizing the text is one of the most important principles of elementary education. I can speak from experience, having required this in my own teaching for the past three years. Our students in far the larger number are qualified only for elementary methods. Why then adopt so generally methods adapted only to educated minds? Fifty years ago the larger number of those who offered themselves to the professions were graduates from literary institutions. In cases not of this class they were persons who showed unusual aptitude for study, and were self-educated. Such men are qualified by discipline and development of mind to receive instruction through the medium of lectures. What I have said thus far is designed to stir up the minds of teachers and students, and the profession generally, to the necessity of simple, brief, elementary text-books of dentistry,—not elaborate, exhaustive treatises and reference-books, but books of rules, principles, facts, and illustrations, pointedly and concisely stated, so that they can be readily memorized by the pupil.

Another, a very shining mistake, is, as I think, found in the large number of instructors employed in our colleges. The long list of clinical instructors is peculiar to dental colleges, and constitutes a sort of dental college pageantry,—a glamour of shining names and titles to attract the eye. The long list of titled men proclaimed in an announcement *sounds* well at a distance. They are as meaning as a Chinese gong at the door of an eating-house. But looking at the matter candidly, let me ask, are not these long lists of names more for the purpose of attracting attention and for securing the influence of such names in bringing students to the college than for the legitimate purposes of education? The system is held up before the eye of the student as an important feature of this or that school. In politics such a measure would be called *bombast;* and in educational matters, is it not a kind of stuffing used to swell the college measure to commanding proportions? When occasionally the opportunity is offered of securing some highly valued service from a distinguished operator it certainly cannot be objected to. When objection is made to the large number invited, the reply is made,

"It is not expected that many of them will be present to operate: not more than one in ten ever appears at the school." This only shows the falseness of the pretence. Yet there are those who honestly believe that a large clinical corps of instructors is a very great advantage to the student in acquainting him with the different methods of distinguished operators; and some colleges advertise the presence of one or more such every week of the term. Query: Is it an advantage, or an evil, to give to the student in a ten months' or in an eighteen months' course a great variety of methods of operating? Is it well to even attempt to give to the student, while in his college course, *all* the ways and methods known to the profession? Will he not come out better at the end to give his attention to the ways and methods of *one* good operator than to have his student-life vexed with a variety of methods, with the probability that he will acquire no method *thoroughly?*

It is easy to decide upon the question of methods when you go outside of dental schools, and observe methods in other departments of instruction.

Learning to operate at the dental chair is not essentially different from learning to write at the desk. Both are manual and mechanical operations aided by oral instruction.

Suppose a pupil wishes to learn the art of writing. Shall he have *one* instructor, or *many*, each writing a different hand? Shall he form his letters after the pattern of *one* master's hand, or shall he have a new master every week, with some modification of the forms of letters pertaining to curves, angles, loops, slope, and relation of long to short letters? One week he writes a round hand; the next week under a new teacher he writes an angular hand; then under another teacher he writes a semi-angular hand, and so on with slight variations every week. What sort of a hand will the boy write at the end of the term? He will have a disjointed, irregular, illegible mixture of styles, void of all symmetry and grace.

There are various methods of teaching the science of numbers. Would you put a boy who knows nothing of arithmetic under the instruction of three or four teachers, each with his different methods of calculation?

If in none of these instances it is desirable to multiply methods by multiplying teachers, why is it desirable to multiply methods in teaching the science and art of dentistry?

After a student has become proficient in one method, it is time enough then, and after he has left his *Alma Mater*, to acquire the

methods of other schools and other instructors. This he can do with profit, in some cases, at least, by attending the various State and district societies, which are the colleges of the profession.

There is another method of instruction which I fear very much to touch in criticism, because of its popularity, and lest I should be misunderstood. It seems quite impossible even for the best masters of rhetoric, belles-lettres, philology, and elegant literature to so construct language that it may not be misconstrued and drawn from its intended meaning. The method or custom to which I refer is that of intrusting, to so large an extent, dental education to those who have had no special education in dentistry. While it is true that medicine and dentistry are based upon the same fundamental sciences, each requires a different grouping of facts and principles to be presented to the special consideration of the students of the respective professions. One educated for the medical profession and not the dental, the whole current of whose thoughts eddies around the medical practice, cannot make the proper grouping of facts and the proper applicaion of principles for the dental student.

Take for example the science of chemistry. This is considered one of the medical sciences. Suppose it is taught as an abstract, independent science, apart from those groupings of facts and lines of thought which tend toward the medical practice on the one hand and toward the dental practice on the other, neither the medical student nor the dental student derives much practical benefit from the lectures. The student wants *medical* chemistry or *dental* chemistry, not abstract chemistry. The dental student also needs *dental* physiology, and *dental* pathology, and *dental* therapeutics; to teach which profitably to the student, the teacher must himself be a practical dentist. A medical graduate who had passed through one of our university schools where the professor of chemistry was second to none in the land, so far as the abstract science was concerned,—for before him all material things seemed analyzed at his touch,—told me that after taking two full courses in chemistry he did not bring away with him from the college the kind of chemical knowledge that was of value to him in practice. He got too much chemistry and no medicine.

A dental practitioner whom I met on the cars on my return last year from the International Medical Congress, and who seemed like an intelligent man, told me that after graduating from both medical and dental departments of one of our foremost universities in the East, he did not feel competent to open an office and practice.

What was the matter? I asked. His reply was, "Too much medicine and too little dentistry." A student studies dentistry not merely for the love of science, caring not what the science is, but he studies it for the sake of a livelihood. As desirable and important as deep and broad foundations are, they may be made *so* deep and broad as to exhaust one's resources and prove an obstacle in the way of rearing the superstructure. A man who wants a house to live in cannot afford to spend a life-time in laying the foundation.

The books of fundamental science used in medical colleges are not adapted to the wants of dental students; hence the two classes cannot be educated together without a useless expenditure of time on the part of the dental student. I use the terms useless expenditure and waste of time guardedly. Do not misunderstand me. I do not use the word *waste* in any absolute sense; it is a waste of time only relatively to the aim and purpose the student has immediately in view. He must take it for granted at the outset that all he will get in the college term, of any branch in the curriculum, will be but a compendium of the science. It becomes therefore a matter of wise discrimination as to how far and how much relating to each branch of study he will attempt to obtain during the term. The medical student is expected to give as much attention to the anatomy of the foot as to the anatomy of the face; because, looked at from the stand-point of practice, they are equally important. But the dental student, receiving his instruction in anatomy in the same class, does not look upon the anatomy of the face and of the feet as equally important from the stand-point of the dental practice. He will never be called to the foot professionally; he will always stand at the head. However desirable it may be for him to understand botany, geology, mineralogy, and other correlated sciences, he has no time for these during the college term. He has only time for that which is considered necessary in preparing him to enter at once successfully upon the practice of dentistry. What he has omitted must be taken up afterwards: to do which he must become a life-student.

SECTION II.—Continued.

The Education of the Dentist Yesterday, To-day, and To-morrow.

PAPER BY D. R. STUBBLEFIELD, OF THE SOUTHERN DENTAL ASSOCIATION.

IT does not require a Methuselah to look back to the birthday of Dentistry. She has made such rapid strides forward among the sciences that, though comparatively young, she demands and receives recognition at the hands of the most erudite. Her ranks are filled by all kinds and nationalities of men, who have all varying degrees of natural fitness. But there was a time when this cosmopolitan condition did not exist. Then the field was new, and filled almost entirely by uneducated men. There were, however, a few daring souls who appreciated its importance and who felt an impulsive urging from within of a bias for its special duties and demands. They were the self-elected leaders of a forlorn hope, as it were, and did not expect much but hard work and poor appreciation of their services. But like Gideon's little band, they were filled with that indomitable determination to succeed that almost always wins the battle, tunnels the mountain, or gains the victory of any kind. Conversely to a survival of the fittest, they were the fittest, volunteering themselves to do or die in a chosen life-work.

The point I mean to make is that each candidate for the then questionable honor of being a dentist was, by reason of his self-election, generally equipped with a special aptitude for dentistry. There were exceptions to this general rule, doubtless, but they were only sufficient to prove the rule, not invalidate it. The outcome was so uncertain that each applicant for the then questionable honor determined his fitness by a thorough investigation of his own powers, and then fully consecrated himself to his work. Each filled his own proper niche in life. Each had a single purpose and was devoted to his cause. Each was willing to work in the very face of poor oppor-

tunities to learn, and poorer facilities with which to work. It was by dint of effort often repeated, and against failure as constantly recurring, that success was at any time to be achieved. General education was rare, not the rule. Professional generosity was not born, and narrow-minded jealousy stood ready to kill the inquisitive learner. And it was not strange that each was so niggard with his hard-earned store, when we remember that the daylight was not broad, but only the dawn threw its uncertain beams upon them. Our Pilgrim Fathers constantly carried their arms against the ever-possible attacks of the destroyers; so these, our professional fathers, guarded their small secrets and jealously kept them against the treachery of others, as they understood it. To be sure, it is not our way, but the customs of that day and this differ widely, and the sun of professional generosity had not dispelled the mists and fogs of ignorance that still obscured the landscape. In the light of the present they appear almost contemptible, and would be so, but for the extenuation, found easily in their different surroundings, which puts them within the pale of a generous charity. Let him who would have been better under the circumstances that enthralled them cast the first stone. I do not condone the fault, but I demand a fair and right, considerate, not to say lenient, judgment for the doers.

And yet they need no defender. They did too much, in the very face of confessed disadvantages, to make the foundation upon which we of to-day stand, for us to deny them credit or refuse to be grateful. The perfection of an invention is certainly very commendable, but while we honor the perfector, we must not lose sight of him who conceived the idea from which it grew. Those honest-hearted ones held firmly to their convictions, and dared to promulgate them with their whole lives. They irresistibly command our respect. The world in its ignorance denied the necessity for their work and refused, except from direst need, to allow them a chance to prove its value. Against the tide of these and all other oppositions they urged the bark of dentistry into the haven of respectable recognition. It was a struggle, in effect, like that of the Colonies for independence, against Tory doctors within the scientific world, and all the opposition from without combined. We have much for which to thank these foundation builders of the past, and we would be recreant to all professional heredity to refuse it. They developed appliances; we use them. They founded colleges of special learning; we are the learners. They questioned all methods and put infinite pains upon each; we are easily able to select the best for each

case. They were the garnerers; we the feeders that live upon their grain. Thus in all things the planters of yesterday feed the open mouths of to-day.

The dentists of to-day are the legitimate result of their determined adherence to principle. We stand so nearly related to them that we are necessarily the objects of their benefactions. We deserve no special credit for being even better than those of yesterday, for we can easily obtain the benefit of their work without a tithe of their labor. The sun of scientific enlightenment has revealed the fact, now fully recognized and conceded by the scoffers of the past, that dental science is necessary to the world, and the profession itself is just as reputable as any of the so-called "learned ones"—and is, in fact, one of the learned ones. The world admits that dentistry is a branch of the general healing art, without reference to its being or not being a specialty of medicine, and as such is entitled to all consideration. I cheerfully give the meed of praise to the dentist of yesterday, who, as he was in many instances uneducated, suffered from a narrow view, yet who carried within him the sign-manual of the Creator, manifesting itself in a special aptitude for the work. We of to-day do not flatter ourselves unduly by claiming that, with like careful selection, and better facilities for preparation, we can show greater advancement. But there is a trouble engrafted on us as a body professional,—the discussion of which brings us to consider the dentist of to-morrow,—namely, that the painstaking introspective self-examination is not practiced in the selection of dentistry as one's life-work, as it was formerly done. It is too often the case that the idea of great emolument proves the allurement, and the question of natural fitness is not even considered, much less settled. In other words, too many men are dentists (so-called at least) without self-election, in the sense of being naturally fitted for the work. One becomes a dentist because his father was a dentist, and he loses sight of the fact that heredity has stamped him his *mother's* boy; another becomes a dentist because a boy friend, who is unusually well fitted for it, is succeeding, although he himself may be entirely incomparable to his friend.

Dentistry, now on a plane with other professions, must expect to suffer like them from the entrance of ill-advised votaries, enticed by adventitious inducements. It is an irrefutable fact that men are to-day forging ahead in the professional world by dint of main strength, where pride and intelligence are backed by fair cultivation, who would evince the grandest human ability in other vocations. It is a

pity that inherent power should be misapplied. This could not always be prevented, but judicious selection, based upon mature consideration of character, should be the highest duty of parents. The pride to be this, that, or the other, developed prematurely in a child, should be most sedulously avoided. Too much care cannot be expended to ascertain the trend of the composite inheritance of a child. Pride of station and ancestry should be overcome in the all-important selection of a thoroughly congenial and compatible life-work. The most earnest scrutiny should be kept upon the formative forces bearing upon the child, so that they are not allowed to prove deformative processes, to warp a splendid success into as splendid a failure. The children of any profession are the natural recipients of any hereditary qualification for that profession, but we must not lose sight of the fact that the flow of heredity is deflected and often changed entirely by the other side of the family. Hence no invariable rule can be set to govern people who are not invariable. All of phrenology may not be true, but enough to prove its general truth is found in human faces, built upon substantially the same anatomical bases and with parts that differ but slightly, and yet how different! None can doubt that different men have different qualities of mind as well as different faces, and that, therefore, they are better fitted to pursue some profession than any profession, to advantage. And yet, there is a general intelligence that enables some to follow almost any profession with credit, when faithful application is made. Such men may be thrown out of the channel best suited to them, and still, against a natural bent, they develop success out of failure. None will dare to deny, however, that they would have done more, gone higher, or reflected greater lustre on themselves in that calling that satisfied their whole nature than in the work in which they had been perfunctorily engaged. If this is true, then the special work of dentistry offers the best field for some of the diverse minds of the world.

These very ones I commend, out of which to make the dentists of to-morrow. They are Heaven-elected dentists, if they properly qualify themselves to discharge its obligations.

The profession should demand three things to be done: one by them, one by itself, and one by the schools. *First*, demand that a broad foundation of primary education should be laid, as preliminary to all other intellectual preparation. I go back of professional training in this, and demand the same educational qualifications that the most learned profession ever demands. To prepare for law, they

search all fields of educational lore, drink at all fountains of knowledge, and then put on a capstone of law. Just such a course, I claim, is best, if not always possible, for a dental student; and even more important, since the issue of life and death is, at times, in his hands. More is demanded of the studenthood to-day in all branches than ever before, and dental students must expect exactions commensurate with any other. Added to that trend of character that is the natural qualification, minds trained primarily and cultivated persons should be considered the *sine qua non* for correctly prepared dental students: trained minds, that they may bring skillful intelligence to work out the conceptions of our high and progressive science; and cultivated persons, because our intimate personal associations demand that we be agreeable in necessarily painful duties. Such only would rise to the highest conceptions of our future. The beginners are on an average too crude from which to obtain the best results. They deem themselves well qualified to meet all requirements when they decide to honor our profession with their patronage. The will is essential, but not all-sufficient. The day has come when better methods must prevail. Years ago, it was excusable to commence the study of dentistry without a proper foundation, but I insist that such a course is not up to the requirements of the times. A log cabin or a wigwam might be built upon the level earth, but a Washington Monument, or a Liberty Enlightening the World, must have a deeply-laid and a well-constructed foundation. Dentistry of to-morrow must overtop dentistry of to-day, and the base must be deepened and broadened as the top goes upward. To do this the profession must awake to its responsibility and actively demand of our dental schools that they shall be more exacting as to a suitable preliminary education of their matriculates, and that they shall provide the means necessary and require of their students a broader and more thorough knowledge of the fundamental sciences of medicine and surgery, before graduating them as Doctors of Dental Surgery.

Second, one by itself,—and that is to establish a higher, better moral tone. The old idea that "what was good enough for my father is good enough for me," must be supplanted by a more progressive, a more enlightened, view of our calling and the essential factors that constitute its higher standard. Such a revolution cannot be accomplished in a day. Harvest is always preceded by a preparation and proper seeding, and a long time of patient waiting. But it ought to be done, it must be done, if we intend to rise with the tide of the

general progress of the hour. Each dentist must become a radiant center of elevated moral tone, be the circle that surrounds him great or small.

Third, one by the schools,—which must assist by a sensible elevation of the standard for entrance, a judicious extension of curriculum, and a more rigid demand for thoroughness before conferring degrees. Cast-iron regulations cannot avail, because the modifications at any point are not identical or comparable to those at any other point. Ends must be aimed at; means will take care of themselves. Let the sentiment be unanimous and utterances conform to it. The moral backing thus developed will engender courage to begin the revolution. Be assured, it cannot be wrought by chance, and indifference will result in forging more indissolubly the fetters that bind us to the traditions of our past. Schools cannot do more than reflect the impress of the profession in the aggregate, as seen upon the collected pupils from all sides. Let every dentist constitute himself a committee of one to properly prepare one student. The great rolling river is just what its tributary springs make it, and dentistry will be elevated or depressed by your efforts and mine. It behooves us to rise to the emergency and do our best to discharge the obligation that we assumed in the marriage vows of our high calling. It is unquestionably essential that the schools shall be more thorough, but our duty lies back of their work. We have our responsibility and we must act, we must work, or die out of the way of those who will.

DISCUSSION.

DR. HARLAN: I was engaged in another portion of the building during the reading of these papers, and it seems to me that if the gentlemen who read them would briefly mention the main points they might be much more intelligently discussed.

DR. INGERSOLL: I have always taken the ground before this Association that dentistry is not a specialty of medicine. I hold the same views to-day, notwithstanding the declaration by that very highly educated and learned body, the American Medical Association, that dentistry is one of their specialties; and notwithstanding the preamble to the constitution of this Association says, "Whereas dentistry is a specialty of medicine," I throw aside all the resolutions affirming it and stand still on the same platform on which I have stood for a great many years, that dentistry is not, in the common

acceptation of the term, a specialty of medicine. What is medicine? What does the term imply? It means the medical literature of to-day. Do you find dentistry in our medical literature? The medical colleges distributed over our country are the representatives of medicine as a science and a profession. Do you find dentistry in our medical colleges? Do you find it in the teaching of the professors in the medical colleges? Not one of them can give any accurate instruction on the subject of dentistry. Considered, then, from the stand-point of the literature of medicine, and of the colleges and professors who are duly installed as such, it is not a specialty of medicine. In what sense is it? Only in the broad sense that it has to do with the cure and restoration of certain parts of the body not included in the narrow sense in which medicine is taught and practiced. Hence I have always claimed that dentistry is an independent science. Do you say when you are studying anatomy that you are studying medicine? No, no more than the school-girl who is studying anatomy and physiology in the regular course in the high school is studying medicine. She is studying a common science that belongs to the literature of the world. It belongs to me as a dentist as much as it belongs to any man who is studying for the practice of medicine. I study physiology because it belongs to dentistry as a science. When the school-girl studies chemistry does she study medicine? I took a course of lectures in chemistry before dentistry was known as a science. In so doing I did not study either dentistry or medicine,—I studied chemistry as an abstract, independent science. I do not see in any possible way how it can be known distinctively as a specialty of medicine, except in that broad sense which includes all that is known of the human body; but no medical college in this country makes the least pretence to teach all that. For that reason I have taken the ground that in teaching dentistry we need a separate and distinct series of scientific and practical text-books, because we cannot put a dental student into the same class as the medical student and do for him successfully the work which we ought. So placed he spends a great deal of time in studies which are not going to be of practical value to him. There is no objection to a man attending to the study of medicine to an unlimited extent, but he cannot do it in seven or eighteen months. A dental student cannot possibly comprehend and digest in the months devoted to the study of dentistry all that is required, and in the same time accomplish all he ought in practical work in order to fit himself to be a practitioner of dentistry. That is the reason I object to the pretence

of taking a man in five, six, or seven months through an entire course of medicine and an entire course of dentistry.

DR. MORGAN: The most radical view taken in that paper was as to the manner of imparting knowledge. I subscribe generally to what was said upon the subject of dentistry being an independent profession. I believe if you were to look back into the literature of our profession some twenty years you might find me committed to the opposite view, but I hold the right to change my opinion while I have a reason, and I now look upon dentistry as my brother does, as an independent profession. If you were to wipe out every medical college in the world and make a bonfire and burn every book that is printed strictly for medical purposes, it would scarcely make a ripple in the dental profession, and we should go along just as we are going along now, and be able to teach as thoroughly and to qualify men as fully for the practice of dentistry as we now are.

The particular point in that paper to which I allude is as to the manner of teaching by recitation. I am convinced that it is the most efficient, and can be made the most thorough, mode of imparting dental as well as medical knowledge to the student. I am led to this conclusion in part from a little observation upon the procedure of an institution in my city devoted to the education of the brother in black, where they follow very largely that plan. They have didactic teaching covering certain portions of the course, but students are required to a very large extent to recite, especially in anatomy, physiology, chemistry, and materia medica, and I am persuaded from observation that more has been accomplished than could have been in any other way in the education of the black man; and what is good for a black man is mighty good for a white man. I am not sure but that the entire field of prosthetic dentistry could be better taught by recitation and demonstration than in any other way. If you give a boy a lesson in anatomy and bring him up before you and ask him to repeat it, when he has an opportunity of looking at the subject he gets it practically and clearly and distinctly. Like the man who rides along the road and looks at the country once, he will always recognize it again. If he sees a grove of pines on that side and a grove of oaks here and gets a good look at them, he always recognizes them afterwards. You might give him forty descriptions, and it would not be so clear to his mind. To illustrate: I was sitting at a table the first time I saw that gentleman [Dr. Atkinson]. He said, "Pat, can you bring me another nice little piece of tenderloin steak?" Pat went off and was gone a little while (this was at the

Spencer House just thirty years ago), and presently he came in and put it down, and my friend looked up and said, "That looks like the thing." Pat said, "Yes, your honor, there is never a thing that looks so much like the thing as the thing itself."

DR. INGERSOLL: I find in the *Independent Practitioner* of August, 1888, page 444, such a complete illustration of the method I recommend that I want to call the attention of this body to it. If a man wishes to inform himself of the general character and history of the railroads of this country he will be obliged to read a book of fifty pages, and I venture to say that here in a little less than one page is contained all the information and the general facts which will be contained in that book. [Reads from the magazine "About Railways."] When a man has committed that page to memory he can go before an audience and make a better speech than nine-tenths of the first-class railroad men.

DR. CATCHING: I do not know how other gentlemen feel, but I can speak of the relationship existing between the medical and dental journals, and there is a reciprocal feeling delightful to behold.

DR. GUILFORD: The position Dr. Ingersoll takes in regard to teaching students in dental colleges has been spoken of by Dr. Morgan. He advocates recitation in preference to regular didactic teaching. I cannot agree with him, for several reasons. In the first place, it seems to me rather too primary a method of teaching. It is undoubtedly the proper method for children or young men in the beginning of their education, but I do not think it should be adopted in teaching a profession. It is to be supposed that when a man takes up the study of a profession he has had a fair and perhaps a very good preliminary education. Many of the students attending our dental colleges are college graduates and men of considerable mental training. I do not believe it would be correct to teach them as though they were children. Again, if we were to require them to commit to memory a certain number of pages from a text-book and ask them questions upon it, it would take a long while to get over the ground. I admit that this method of teaching would be very thorough, but I do not think it is necessary for those who have had a fair mental training beforehand. While the student is preparing himself for college, if he prepares himself correctly he does a certain amount of studying. In former days it used to be the custom for the dental student to select his preceptor, from whom he would learn the operative part of his work and to whom he would recite under instruction. In that way he familiarized himself with

the contents of certain text-books. Having done that and come to college, he is prepared to receive didactic teaching, and if that is given to him in a proper manner he ought to be able to grasp and retain a great deal of it. I am aware that students get so much in the course of a term that they cannot grasp it all. But what do we do in order to impress upon them the instruction we have tried to impart? After teaching them didactically we have them quizzed. We see how much they understand of what they have gone over. In the next place they go into a clinic room, and perform the operations and put into practice the principles which have been taught; so that we have in the first place study of text-books, then didactic teaching, then the quizzing, and finally the practical application. I know that many students who go to dental colleges are not as thoroughly prepared by early education as they should be. That does not take anything from the argument in favor of the lecture system, because it simply admits that such students fall so much short of being perfect students, and the dental colleges that receive them fail to take high rank as educational institutions.

What text-books would you recommend if you propose the catechetical course? Where is there a work that covers the ground in either prosthetic or operative dentistry? The fact is that these branches are advancing so rapidly that a text-book is hardly written before it becomes obsolete. And if we confine the students to the use of one text-book on each branch, what becomes of all the others that contain much of value? The professor keeps himself informed in regard to his subject, and incorporates into his lectures everything of value obtained from a multitude of sources. In this way the student receives what is newest and best, culled from different works, and presented to him in concise form. When a student asks what the proper text-book is upon a certain subject he is frequently met with the reply, "There is no text-book that I consider fully up to the time, but there are certain ones that are very good." A student would be confined to a single text-book on a single branch, by Dr. Ingersoll's method, but by didactic teaching I think we give him a broader education.

With reference to the question of dentistry being a specialty of medicine, I do not think it matters whether it is such or not. Medicine is carrying forward its own work in its own way. Dentistry is doing the same in its own sphere, and that I think is all that need concern us in the matter.

DR. TAFT: It seems to me to be the most unprofitable line of dis-

cussion that we could take,—this matter of the relation of dentistry to medicine. All the talk we might indulge upon it will not change the relation of things a particle; that will be established by other influences. All that may be said will not convince anybody that dental practice is not a branch, and a very important branch, of the healing and restoring science and art. Every one will agree to this, and that is as far as we need concern ourselves as affairs now stand. We talk a great deal about being independent. Independent of what? What is medicine? That name is used often without any definite meaning. We are not independent of medical colleges. We are dependent all the way through. We are not independent of anatomy or pathology or physiology or chemistry, nor the teaching of these subjects. We are all dependent one upon another. The more we have of medical science, the better are we prepared for the exercise of our special and legitimate work.

The subject of the method of teaching is a very important one indeed, and one that should receive full consideration. This is true of medical teaching as well as of dental. It would be very greatly to the advantage of all concerned if a more nearly uniform method could be adopted. How that is to be done is not clear. The organization of dental faculties has not as yet entered upon that work, or anything very definite looking in that direction. I do not know whether it would not be well to have a normal class of teachers of dental colleges come together at a proper time, and spend a week, or two weeks if need be, discussing the modes and devising better methods. Dr. Ingersoll has given us a splendid paper on this subject. It is true that the dental colleges do not occupy exactly the same level, but that would be attained by a unification of methods.

Some of the methods that have been suggested upon the first glance do not seem wise and best, but propositions that at first impress us unfavorably, upon being better understood seem to be the best. I am sure that by becoming more familiar with each other's methods, and by exchanging suggestions, very much good would result.

DR. CATCHING: It makes me sad to hear a professor in a dental college—yea, a dean—get up and say we could destroy all medical books and colleges without causing a ripple. If I were in such a position and thought such a thing I would never utter it. I would encourage my students to acquire all the medical knowledge they could get hold of, and I would not condemn in any way the medical association or medical education.

DR. ATKINSON: Let me first express my regret at the lack of interest manifested by the audience and all the speakers in the discussing of five or six of the best papers that I have ever listened to before this or any other body.

I know of no school, medical, dental, or classical, that goes to first principles except in name, and the truth has to be revealed to all inquirers by their surroundings independent of the teachers; and I hold that he is the best teacher who so presents to his pupils the subject-matter of his lectures that they can discover the truth while he personally is hidden in the folds of the curtain that obstructed the demonstration from the pupils, by his taking it away and letting the light shine in. I have thought long and earnestly on these matters, and I have learned that the best way to lead a pupil is to lead him very simply. There are two classes of simpletons,—beginners, and the ripest scholars you meet, but they will almost do to class together; for the ripest scholar, having arrived at a little certitude, stands with humility when he looks out upon the field and sees how little he has conquered of that which seems just within his grasp and which he ought to be able immediately to appropriate. These papers will be very much more profitable for us to read at lunch-time than to discuss here, especially as they come in such a hotch-potch mass. The paper now before us (Dr. Stubblefield's) is a beautiful presentment of a very ripe mind on a very elaborate subject, and I was going to say hallelujah while he was reading it. I felt the old Methodist blood stirring in me. I felt that we were all brethren, and I tell you we are all brethren. If you could look back upon the origin of this body and hear the kind of talk we had then and the talk we have now, your souls would leap with joy, and you would feel that you were really beginning to be worthy of the recognition of the world as healers; and you may make the differentiation about medicine and all that flummery and nonsense until you are as gray as a rat, and it will not profit you anything. Who knows how medicine acts? Who knows how oxygen acts? Who can tell us how quinine acts? Who can give us a classification that is worth kicking out of doors to-day as to the molecular metamorphosis and the awakening of the engagement of the bonds of affinity in the primary elements that are wrought into all the organisms that have function on this planet? Who has done it, who will do it? I know one who tried to obey the voice of the angels and give it to you. How well you received it to-day! I don't know whether you understood it. They tell you to take medicine and you will get

well. The old Yankee doctor would shut his eyes after having asked the patient to let him see his tongue and feel his pulse a little while. "You take this and you will get well." That was a pretty good epitome of his diagnosis and prognosis, and he did not know that all the time he was being operated upon by his affections through the desire to do his patient good, and the memory of having given such things under similar and like circumstances and had good result from it. If we have to get the demonstration at each successive step of our mental operations, how are we to formulate that which is to be beneficial to anybody else? They say that medicine has power. If medicine has power it ought to be able to exercise it, but it never exercises it only under certain circumstances. Atoms become molecules only when within the sphere of influence and the current of energy that awakens the latent bonds of these primal elements and constitutes the second order, and that is to be carried on and on by multiplicity of receptions of power and storing of power that rest for the time until opportunity comes for them to be combined in more complicated forms that we call proximate principles or pabulum, perfect peptones, and all that, which will have to be studied more than it has been before we will get the alphabet of knowing how anything may be, according to the necessity of the feeder, either food, poison, or remedy, by reason of the voidness in the feeder demanding the incoming power that it appropriates and by which it is strengthened. That is too fine and evanescent and thin for any of those materialistic scientists who say that matter accounts for all things. When we shall have had the humility to have studied these things earnestly, after having had our hearts broken and our confidences taken away from our teachers by finding that what they told us did not hold good in practice, we shall begin to learn.

HYGIENE.

Chairmen of the Joint Committee, GEO. J. FRIEDRICHS, of the American Dental Association, and H. C. BEACH, of the Southern Dental Association.

REPORT BY G. J. FRIEDRICHS, OF THE AMERICAN DENTAL ASSOCIATION.

I MUST admit that I was considerably surprised upon the receipt of the programme of the joint session of the American and Southern Dental Associations, to find that your Committee had paid me the high compliment of selecting me to make the report on Hygiene. Never having to my knowledge given any tangible evidence either by word of mouth or written thesis to justify the wisdom of their choice, I can attribute the Committee's preference only to one of two motives: firstly, the partiality of friendship; and secondly, the thought that once appointed I would find that the most graceful way out of the dilemma would be not to disappoint their expectations, but to do my very best to present this subject in a manner worthy of the occasion and of the grand Associations I have now the honor of addressing.

This subject extends over such a large field and is so connected in its relations with many kindred sciences, that it is impossible to even make an attempt to give anything like an exhaustive report. Consequently, my aim shall be to confine my remarks and observations principally to hygiene as it relates to the specialty of dental and oral surgery.

The science of hygiene has steadily advanced, keeping pace with the progress of all other departments of science, and through the knowledge acquired and the wise enforcement of its laws the average of human existence has been prolonged. The genius of Ambrose Paré raised the status of surgery upon a parity with that of general medicine. The pioneers in dentistry have likewise succeeded in establishing a specialty in medicine,—the art and

science of dental surgery; but I question the propriety and feasibility of establishing a distinct branch in hygiene. Would it not be preposterous to speak of hepatic hygiene, gastric hygiene, etc.? Yet, not more than a year ago, the subject of dental hygiene was brought up before the Southern Dental Association and discussed seemingly as a distinct branch of this science.

The usual definition of hygiene as being "the art of preserving health" is defective, since it is more than art, because it aims to increase and improve as well as preserve; and the word "health" is too vague to be of much value in this connection. In its broader sense the study of hygiene includes the examination of the conditions which affect the generation, development, growth, and decay of individuals, of nations, and of races, being on its scientific side co-extensive with biology in its broadest sense, including sociology, rather than with physiology merely, as writers state. As regards practical hygiene,—*i.e.*, the prevention of disease,—it is evident we may try to attain this end in two different ways, since we may either attempt to avoid or remove the causes of disease, or to make the body less susceptible to the action of these causes. Considering the great number of causes of disease and the impossibility of shunning them all, even with the greatest care,—nay, that this great care, if exercised, becomes itself a cause of disease, as is expressed by the old proverb, "Medicé vivere, est misere vivere,"—and on the other hand remembering that the power which we have to modify plants and animals by regimen and breeding makes it probable that the human body might in a like manner be improved, to use the phrase of Royer-Collard,* by a sort of hygienic organoplasty; it might at first sight appear strange that more attention is not paid to this branch of preventive medicine. Theoretically it is possible to thus improve the physical condition of the individual, and to be effectual it would be necessary to work in accordance with the laws of natural selection and prevent the production of weak and unhealthy persons,—a problem which I fear none of us will live to see solved.

"Hygiene commences the moment when two animated wandering microscopic molecules meet and mingle into that one other which is to grow into what you and I are until fifty, sixty, perhaps a hundred years after, its elements are given back to the cosmic store-house whence they have been borrowed. If we have minds that enable us

* Organoplastie Hygiènique, ou Essai d'hygiène Comparée. Mém. Acad. Roy. de Med., 1843, x, 479 pg.

to know ourselves, intellects to reason why we are, sensations to perceive our environments, emotions to link us to our fellow-beings, is it not only because within the corporeal form there is a mass of cells, a structure sound in all its parts, nourished by pure blood, formed from good food, drink, and air? Close, one by one, the windows of the soul out of which it looks upon the world or in upon itself, obliterate vision and hearing, touch, taste, and smell,—be the tenant within never so great or grand, he is buried in a tomb that has no exit. A thing so beautiful, so marvelous, ought to command our profoundest admiration and ever-zealous care. Fashioned in the image of the Creator, made but a little lower than the angels, why should we neglect this thing of flesh and blood, bone and sinew, till its beautiful outlines are marred, its parts jangled and out of tune, its vigor wasted? Intuitive self-interest alone ought to teach us to care day and night with earnest, watchful thought for this living, moving, feeling, thinking body. Neglect of the body without doubt is the most frequent cause of all the suffering and sorrow of our mundane existence."

When Prof. Mutter subcutaneously divided the tendo-Achilles about fifty years ago, Dr. John Rea Barton, who was at that time by common consent recognized as the surgical chief of Philadelphia, protested vehemently against the operation and refused to witness it, unwilling to give his countenance to something then considered so dangerous. Mutter's prospects for life would certainly be blighted. The great fact of the protected immunity from suppuration, when subcutaneous incision is made, had not yet impressed itself upon the surgical mind. The rationale is explained to-day. Antisepsis is the legitimate descendant of the subcutaneous cut. The tenotome would almost surely be cleansed as it passed through the skin and the minute wound would be washed by the few drops of exuded blood. This was clearly our antisepsis.

The microbal discoveries of Pasteur and Koch and their disciples have placed our therapeutics upon a new basis. The surgeon opens the various cavities of the body not only to repair injury, but to remove the results of morbid processes. If disease obstructs the bowels, he cuts it out and joins the healthy ends of his cut; if the lungs are the seat of abscess, he punctures and drains them; if the brain has an abscess pressing on it and endangering life, he punctures, drains, and renders the wound aseptic. But let us not forget to give due credit to Dr. Morton for the discovery of anesthetics. The introduction of anesthetics at once enlarged the field of operative surgery

in the first place by enabling patients to undergo operative procedures which otherwise could not be endured; in the next place, by enabling many persons to cultivate and acquire operative skill and experience who, without the aid of anesthetics, would have shrunk from the dread ordeal of performing a surgical operation. The introduction of anesthetics inaugurated an era of unprecedented enthusiasm in the cultivation of every department of surgery.

When pointing to the many benefits that mankind has received from the labors of the medical profession, we naturally place at the head the trifling operation of vaccination. This is a contribution of surgery. Next to this stands the practical extinction of scurvy, which decimated the crews of vessels on long voyages, seriously crippling commerce. The result must be placed to the credit of the hygienist. The annihilation of pain whilst undergoing surgical operation must be credited to dental surgery. Koch is credited with the assertion that the student will soon know septicemia only by description, as he now knows scurvy. This is the addition to science by the bacteriologist.

Dietetics is now shorn of much of its empirical crudities, and, though still incomplete, it stands to-day in the very front ranks of medical art for accuracy, efficiency, and importance. Dietetics has joined hands with organic chemistry to solve the problem, What is the pabulum of physiological life, and what are its relative and component elements? and with physiology to more clearly elucidate the occult functions of digestion, assimilation, and nutrition,—the waste and repair of vegetable and animal tissues.

The question, What is the best substitute for human milk? still remains *sub judice*. Cow's milk, somewhat slightly modified, seems to be the most rational and favored as a substitute for the mother's milk. This generally accepted belief is based partly on experience, and partly on the physiological precept that there can be no digestion of starch food prior to dentition. But experience and precept are sometimes both upset in cases of infants who do not digest milk, but who digest modified starch foods. Nauquelin found that a mixture of cow's milk and meal broth was the next best thing to woman's milk. Jäger also recommends this mixture, but with the very ambiguous remark that the addition of farinaceous material to cow's milk makes vegetable milk still more vegetable; adding that when children are fed with meal broth and milk the teeth seldom appear before the eighth and usually not before the twelfth or sixteenth month. But we are assured that the nutrition of the bones

is not thereby disturbed, and that that of the teeth is actually improved; for, though the eruption of the permanent teeth is delayed, when they finally do appear they are all the better developed.

In Dr. A. H. Buck's "Treatise on Hygiene and Public Health," I find the following case related. "A lioness in the Zoological Gardens in London several times had cubs with cleft palates. Afterwards, having been fed during a subsequent pregnancy not only, as heretofore, with meat from which the bone had been removed, but with meat and bone together, she gave birth to a cub with normal buccal cavities." * The author adds, "If a simple change in the food during gestation, other conditions remaining unaltered, can bring about so important a result, we must infer that the state of pregnancy has a very important bearing upon the development of the osseous and dental systems."

I was consulted by a lady some years ago, at the time in the seventh or eighth month of pregnancy, as to the advisability of having a tooth extracted which was causing her intense suffering,—to give her own words, "she would go crazy if not relieved of her pain." Having under similar circumstances extracted many teeth without serious consequences following, I advised the removal of the tooth, to which she readily consented, and relief followed. In due time this lady gave birth to a child with congenital fissure of the palate accompanied with hare-lip.

In the first case cited, the supposition is that the cause for imperfect formation was the lack of lime-salts. Yet we know that the tissues may be bathed or saturated with lime-salts, but if they be not taken up or appropriated their presence is of no value. Nutrition is a tissue-function; the act of this process is the appropriation from without of the materials which enter into the composition of the living frame, or of others which may be converted into them in the interior of the body. What we know is that there is a force that directs to formation as certain as that intercepted light will cast a shadow. Germ potency determines not only the time for the appearance of an organ, but directs also its form and function.

In the second case, diet had certainly nothing to do with it, as far as I am aware, for the lady evidently pursued her customary manner of life. This being her fourth child, the others being normally developed, it may be well supposed she was astonished upon being informed of the imperfect development of the child to which she

* Berl. Kl. Woch., 1875, p. 668.

had just given birth. Some reason had to be assigned. Her medical adviser having luckily learned from her that she had had a tooth extracted during her pregnancy, came to the profound conclusion that the "fons et origo" of her misfortune must be attributed to this unlucky circumstance,—an opinion in which he was sagely supported by two learned members of the dental profession. Now, the question presents itself, Had the extraction of the tooth anything to do with it? Next, was not the fetus, at that stage of development, so far advanced in formation as to preclude any outside interference from nervous impression or shock? These questions I will leave for you to decide.

Oral hygiene is of the utmost importance to every one who has the object of health in view. A hygienic condition of the oral cavity tends to preserve the teeth, which give natural expression to the face and tone to the voice, and are nature's instruments for the proper mastication of food, which is necessary for the maintenance of health. And it is a well-established fact that the fluids of the mouth are changed from their normal conditions when the digestive organs do not perform their functions properly, and there is no doubt that could perfect hygienic conditions be obtained and maintained, perfectly organized teeth would result, dental caries become a disease of a past generation, the forceps an obsolete instrument. But I fear we shall not nor will our immediate posterity live to see this millennium.

It is conclusively established that the decay of the teeth is due to chemical action of acids generated in decomposed food between and around the teeth, and that the micro-organisms present in the oral cavity are the prime factors in producing this condition; that without their presence no acids or fermentation would ensue. Consequently, of late years efforts have been made by scientific investigators to discover some germicide that would destroy these fungi in the mouth, and that would at the same time not be deleterious to health, in the belief that through such measures caries of the teeth could be prevented. So far no agent has been found to answer this purpose.* The opinion widely prevails that micro-organisms are antagonistic to health. However, if there is any truth in the theory advanced by Sir William R. Grove, F.R.S., that "antagonism" is an essential factor of human existence, micro-organisms only fulfill the functions that nature intended they should. His statement is this:

* *Dental Cosmos*, vol. xxx, p. 534.

"I propose to adduce some arguments to show that 'Antagonism,' a word generally used to signify something disagreeable, pervades all things; that it is not the baneful thing which many consider it; that it produces quite as much good as evil; but that, whatever be its effect, my theory—call it if you will speculation—is, that it is a necessity of existence, and of the organism of the universe so far as we understand it; that motion and life cannot go on without it; that it is not a mere casual adjunct of Nature, but that without it there would be no Nature, at all events as we conceive it; that it is inevitably associated with unorganized matter, with organized matter, and with sentient beings." Among other evidences which he adduces to confirm his theory, he quotes the discovery made by Prof. Metschnikoff: "He is said to have proved that the white corpuscles of the blood are permanent enemies of bacteria, and by inoculation will absorb poisonous germs, as it appears going on between them. If the corpuscles are the conqueror, the bacteria are swallowed up and the patient lives. If the corpuscles are vanquished, the patient dies and the bacteria live, at all events for a time." Possibly, if there were no bacteria and the corpuscles had nothing to do, it would be worse for them and the animal whom they serve.

We speak of teaching hygiene to our patients and the public, but in my estimation we should teach it first to our own profession. Not long ago I had occasion to pay a visit to the office of a brother dentist. In coming within three feet of his chair, my olfactories were nauseated by the products of bacteria. Others again, I have been informed, never wash their hands in going from one patient to another, use the same napkins or rubber-dam that had been used upon previous occasions, never see or care whether their instruments are wiped or rendered aseptic. It is therefore not surprising to learn —which fact is published in the Transactions of the American Public Health Association—that a New York dentist not long ago communicated syphilis by means of his forceps.

The foregoing are minor transgressions of the laws of hygiene; but how can we excuse or extenuate the ignorance or woeful neglect of those who know better, who allow pathological conditions to exist in the mouth day after day, placing life in jeopardy simply for the sake of retaining an ulcerating tooth or root a few days longer in the jaw, when it is positively established that the system in a hygienic condition cannot and does not tolerate such a condition as long as it is in its power to eliminate all morbific influences? We must also recollect that this process, when accomplished by the

inherent forces of nature, is always accompanied with suffering and pain, and that the life of the patient is at stake.

To substantiate these assertions I will cite a few cases out of many which I could bring before you. First, I will refer to a case published in the *British Journal of Dental Science* for July, 1888, page 597: "Fatal Case of Pyemia from Dental Caries." Dr. H. L. Coopman, the unfortunate individual who had this case in charge, states "that we would seldom have to regret the loss of a patient from apparently so trifling an ailment, provided of course that extraction is not postponed too long, as it was in my case."

A death occurred lately in New Orleans from pyemia,—so I was informed by the attending physician, a prominent member of the medical profession,—the primary cause of which was an ulcerating tooth under treatment of a dentist before the case came under his charge.

Lately, a physician sent a case of abscess of the lower jaw to me, which had already been lanced from the outside by him without material improvement having taken place, for information as to whether the tooth which was occasioning the trouble could be removed,—the parts involved being tense from infiltration, and trismus existing. The history was as follows: Some six months ago this patient was suffering pain occasioned by a lower wisdom-tooth. For relief he called upon a dentist to extract it. Two attempts were made to accomplish this, but without success. The dentist then proposed to treat it and save the tooth. The case was treated and an oxyphosphate filling inserted. The tooth remained quiet for about a month, when it again commenced to give trouble. He again called on his dentist, and palliative measures were employed to give relief; but instead of matters improving, an abscess formed, causing him suffering so severe as to confine him to his room. The family physician was sent for, who, finding the abscess pointing externally, opened it at once, and as soon as the patient was able to leave the house he sent him to me for advice. To make a long story short, chloroform was administered, his jaws pried open, but instead of removing only one tooth it was found necessary to remove three, for the alveolar process had become so disorganized from the infiltration of pus, and so corroded, that after removing the wisdom-tooth the others could be picked out with the fingers; in fact, since the operation I have removed a sequestrum of the alveolar process with a pair of filling-forceps. The case is convalescent, and I think beyond danger from pyemia.

Last week I was consulted in regard to a case where the antrum was involved. The subject is still a young man in years. The history of the case as related by him showed that the cause of the trouble was a carious bicuspid in which the pulp had become exposed. His dentist advised killing of pulp and filling of root, promising him relief from present and future trouble and the preservation of the tooth besides. This was done, but in spite of the care and treatment bestowed upon the tooth, an abscess developed and continued to ulcerate, until finally the antrum became involved. In the end, both the second bicuspid and the first molar of the right side, superior maxillary, had to be removed in order to arrest further progress of the inflammation, the result of which was to leave an opening at the present moment, six months after the removal of the teeth, between the oral cavity and the antrum large enough to easily introduce an ordinary lead-pencil.

Now, you all know, and I defy contradiction, that the timely removal of the bicuspid would have obviated all the suffering attending the course above pursued, without the loss of another tooth; for the young man has an excellent constitution, is without hereditary taint, and these are the only teeth missing in his jaws.

The cases recited above indicate an indifference to the first principles of hygiene, I fear, too widely entertained by the profession at large. I do not suppose anyone imagines that I propose to advocate the indiscriminate extraction of teeth where these morbid conditions prevail; but what I assert is, that when there is merely a question between a doubtful chance of saving a tooth and a certainty of endangering the health,—perhaps the life of a patient,—there should be no temporizing, no hesitancy whatever. It is simply a question of judgment. In cases of this kind, the wisdom lies in knowing when to and when not to extract the tooth. Still, how can we consistently blame the individual when the responsibility to a great extent lies in the teaching proclaimed off and on at our society meetings and published to the world in our dental journals? Who has not heard it asserted in our associations and by their most prominent members that every tooth or root ought, should, and must be saved, without exception,—this being the only correct practice, independent of diathesis, as indorsed by the profession,—and that whenever a tooth or root is not saved for a life-time, the blame lies at your own door, and it is because of a lack of knowledge and skill that you are unsuccessful in your attempts?

Let us cultivate a better understanding of the laws of hygiene,—

appreciate and apply them in the practice of our profession to the very best advantage. Then there will be no need for a mental reservation when we assert, as I have seen it somewhere stated, that "there is no question whatever that the dental profession is fully abreast of the times in all that pertains to therapeutics and materia medica. We make use of everything in the way of antiseptics or germicides, and we have among our members men of the greatest ability, whose researches have enriched the literature, not only of our own profession but that of medicine also."

We all know that the most terrible disorders often arise from the most trifling circumstances; that disease in its incipiency is usually soft and hesitating, but its progress once assured, its powers strengthened, it arises a monster which derides human effort and whose sting is the arrow of death.

Could the grave reveal its secrets, I have no doubt that thousands are there, untimely cut off in the midst of their careers, whose lives might have been prolonged to their natural terms, in whom the first fatal impulse was given through the neglect of, indifference to, or ignorance of the plainest rules of hygiene as applied to the oral cavity.

DISCUSSION.

DR. ATKINSON: I wanted an opportunity to say something about this paper and to make a sort of confession. Either the angels or I am at fault. I did not give Friedrichs credit for writing such a paper. I did him a great wrong, or else the angels wrote the paper which he gives out. I do esteem it one of the most concise and logical and regular in its order of any paper on the subject that I ever heard or read. But it is of little matter what our personal judgments are of each other if we can get rid of the personal accusation of the everlasting *ego* that stands up to be admired. That is the trouble, that we are not imbued with the spirit of our subject enough to forget self. Whenever we are so entirely illuminated with the subject in our minds as teachers as to forget where we are or who is listening, we are then in a good receptive condition by which to give forth with clean perspicuity the words with which we clothe our concepts, and that is what people get together for so much. You know that musicians come together, religious people come together, and they come within the sphere of the influence that I have tried to take you down to the last analysis of so many times (and you have kicked so like mules that I have got dis-

couraged from pursuing the subject any further), so that we should be able to get at what the first postulates are of what constitutes life. Any departure from health will be disease, and that disease may be either within the range of our conscious perception or it may be a sub-consciousness. We have a consciousness that is independent of time and place, we have an organic consciousness that enables us to hold ourselves together as an individual congeries of organs, and then we have the tissueable togetherness that is a consciousness, and then we have the corpuscular consciousness, and we have the molecular consciousness and the atomic consciousness, all of which have to be awakened by an influxion from without that we have been very badly taught about. It was supposed that the influx could only come through a certain set method of teaching by a certain radiant or prepared set of teachers. When the truth is nigh thee, even in thy mouth, the hungry soul shall be made fat. It is this hunger of the atoms to unite, of the molecules to unite, of the corpuscles to unite, of the tissues to unite, that makes the beautiful system in which consciousness holds its court. That is the point of illumination, so that we have to get this body that we have talked about just in a sevenfold series; and we never get it in any greater amount than that without getting very serious consequences to the function and body.

What is tonic? What is stimulant? Who can tell? Who will tell? He only will tell who with Miller shall earnestly and faithfully inquire with expectant mind and not everlastingly by jerking when he is led, going stubbing and stumbling along with stiff knees. A tonic is any food that enters into the tissues of the body and makes them strong. A stimulant is anything that starts the fluids of the body in such condition as to waken them up but does not enter into and communicate strength to the part. That is the *a*, *b*, *c* of that condition of health and of disease, and we must get at that and get away from that which has been held sacred as teaching; and as some one spoke about burning all the books, I would say hallelujah when the hour would strike when they should be burned. Then we would have something that would mean something. We would not be like wild animals in the woods that lock their horns and fight for something that neither of them knows anything about. They think they do it, when it was something that was brought into them that did it. That is so with human beings, too, for we are but an aggregation of all the orders of the mammalia on this planet, brought up into that magnificently beautiful shape that we call the

human body. And I see men now about me who, if all the colleges of all kinds were away, we would save these and have bread and butter enough to go on so that we could see eye to eye, and the millennium would come to-morrow morning.

DR. PATRICK: There are positive facts in every one of the sciences that medicine is built upon. No man of common sense who knows anything about medicine will say for one moment that any professor of medicine claims that the practice of medicine is a science. It never was and it never can be, out of the very nature of things. You pick up a book on the supposed science of medicine. You do not find that it is called a science. A professor lectures on the theory and practice of medicine. There is such a thing as the science of astronomy, also of chemistry, also of anatomy,—so complete a science that Owen was capable of taking the bone of a bird and of reconstructing the whole animal, and the bird, years afterward, was discovered in the ice of Siberia exactly as Owen constructed it. It was the same with the mastodon. The mastodon was taken out of the ice at Siberia with the hair on it, and it was reconstructed from a tooth previous to its discovery. There is not one of these sciences that has not a spiritualistic side, not one. Chemistry has its alchemy,—in fact alchemy was the father of chemistry; astronomy has its astrology. They had their origin in the spiritualistic part before they became positive sciences, every one of them. Aristotle, probably the greatest naturalist of antiquity, wrote one little book which he called Physics, a collection of a few facts. It was small,—you could carry it in your vest pocket. But he went to work and wrote another work that he called Metaphysics, embracing two or three volumes. But what Aristotle wrote on physics is good to-day, and what he wrote on metaphysics is not worth a snap. The very moment you depart from the knowable and flap your wings in the unknowable you are lost.

PRESIDENT ABBOTT: I wish to say a word with reference to this joint session of the American and Southern associations. It was thought that this would not be a profitable meeting to either the men of the North or the men of the South. I believe, however, that every one who thought that at first has changed his mind very materially. It has done one thing: it has brought us together from the North, South, East, and West; and as far as I am concerned, and I am very sure as far as every member of the American Dental Association is concerned, we have been highly pleased with our visit

to this beautiful city of Louisville. Notwithstanding the peculiar and very unpleasant weather we have had since we have been here, we have all found time to get acquainted to a great extent with one another, and we have grasped one another's hands as friends. Let this be the beginning of our friendship. Let us not hear or know that there is such a part of the country as North or South. Let us all feel that we are brothers, that we are working for the general good; and let us work as harmoniously as it is possible for brethren to work together.

PRESIDENT CATCHING: I assure you that the meeting of the Southern Dental Association with the American Dental Association has been a source of wonderful pleasure and delight. We have cultivated friendships, we have formed attachments, and I do hope that we will never find anything to estrange us, and that we shall all live in one common country, engaged in one common profession. To the citizens of Louisville, on the part of the Southern Dental Association I return you our heartfelt thanks for your generous hospitality and your kindness shown in every way. Our stay in your lovely city has been most delightful and agreeable.

DR. STOREY: Behold how good and how pleasant for brethren to dwell together in harmony!

STANDING RESOLUTIONS.

The following standing resolutions are in force at this time, August, 1889:

Resolved, That henceforth no person shall be received as a delegate who is in arrears for dues, or until he has paid to the Treasurer the full amount due at the time his name was dropped for non-payment.

Adopted August, 1874.

Resolved, That hereafter no dental college shall be entitled to representation in this Association that does not require a good English education as a preliminary qualification for its matriculants, to be ascertained by examination.

Adopted August, 1879.

Resolved, That in order to secure representation in this Association, dental colleges must, subsequent to October, 1881, require all students entering therein to take two full courses of lectures previous to coming forward for examination and graduation, and must also state these conditions in their next annual announcement.

Adopted August, 1880.

Resolved, That hereafter no society shall be entitled to representation in this Association that does not require its members to live up to the requirements of our Code of Ethics.

Resolved, When it comes to the knowledge of the Committee on Credentials that any applicant for membership is violating our Code, said applicant shall not be received, and all such applicants shall be referred by the Committee to the societies whose delegates they are, and in no case shall this Association be compelled to treat with violations of the Code, except where the violator is a member of this body and has no membership in any local society.

Adopted 1881.

Resolved, That the Secretary be instructed to assign members who may neglect to make their own choice the Section in which they are expected to work.

Adopted 1879.

Resolved, That the reports of Sections shall be called by the President in consecutive order, beginning each succeeding year one number higher than on the preceding year.

1879	commencing	with	No. I.	1887	commencing	with	No. II.
1880	"	"	No. II.	1888	"	"	No. III.
1881	"	"	No. III.	1889	"	"	No. IV.
1882	"	"	No. IV.	1890	"	"	No. V.
1883	"	"	No. V.	1891	"	"	No. VI.
1884	"	"	No. VI.	1892	"	"	No. VII.
1885	"	"	No. VII.	1893	"	"	No. I.
1886	"	"	No. I.	1894	"	"	No. II.

Adopted 1879.

Resolved, That a paper presented to the Committee on Voluntary Essays and by them considered and returned to the writer with notification that the said paper is not accepted, cannot afterwards be read before the Association unless it is made the special order by resolution adopted.

Adopted 1885.

It shall be the duty of the Executive Committee of the Association to provide at the opening of each annual meeting a book for the registration of members or visitors as they arrive, which shall also give place of residence and hotel where each may be found.

Adopted 1886.

Resolved, That in the future this Association discountenance the giving of banquets, excursions, entertainments, etc., by local professional societies or individuals, either during or at the close of our annual meetings.

Adopted 1886.

Resolved, That it shall be the duty of the chairman of the Credentials Committee to procure and keep a book wherein each delegate who wishes to be considered a permanent member of this Association shall enter his name.

Adopted 1886.